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Pharmacist Collaborative Drug Therapy Management in U.S. Hospitals

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PHARMACIST COLLABORATIVE DRUG THERAPY MANAGEMENT IN U.S. HOSPITALS

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Dedicated

to

My Family

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I would like to dedicate this thesis to my family, my parents and my sisters, for their infinite patience, support and encouragement.

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ABSTRACT

Mishra, Pragya, M.S., Purdue University, December 2014. Pharmacist Collaborative Drug Therapy Management in U.S. hospitals. Major Professor: Joseph Thomas III.

The objectives for this study were to 1) assess the current extent, scope and perceptions of CDTM in U.S. hospitals, 2) determine the associations between hospital characteristics, pharmacy director characteristics, and perceptions of CDTM, 3) investigate hospitals' short-term and long-term plans regarding CDTM, and 4) identify pharmacy directors' views about the major facilitators and barriers for CDTM in hospitals

A self-administered written survey was mailed to a national random sample of hospitals stratified by state. Pharmacy directors indicated whether any pharmacists were engaged in CDTM, what CDTM activities were permitted, and in what treatment categories CDTM was permitted. Demographic data was also collected on both pharmacy director characteristics as well as hospital characteristics. All respondents were asked to indicate their views of CDTM in terms of support for CDTM, financial impact of CDTM, strategic impact of CDTM and effect of CDTM regulations on practice, on a 5-point Likert-type scale, where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. The respondents also indicated their plans for expanding CDTM in their hospitals on a 5-point Likert-type scale, where 1 = large decrease, 2 = slight decrease, 3 = no change, 4 = slight increase, and 5 = large increase. All respondents were asked in open-ended questions to indicate what they perceived to be the greatest barrier to CDTM and the greatest facilitator of CDTM. Logistic regression

was used to assess associations between demographics and CDTM. To test for response bias, chi-square tests compared CDTM and demographics of early and late respondents. An a priori alpha of 0.05 was used for all statistical tests.

Of 1,024 surveys mailed, 84 were returned after failing to be delivered. Of the 293 responses received, 7 were incomplete, leaving 283 usable surveys (30.1% adjusted usable response rate). There were no significant differences in demographics or CDTM use in the earliest 1/3 and latest 1/3 of respondents indicating no response bias. Pharmacists were engaged in CDTM in 66 percent of hospitals. Most hospitals allowed pharmacists to order laboratory tests (58.7%), adjust drug strength (57.9%) and change frequency of administration (53.8%). Hospitals mostly permitted CDTM for Anticoagulation (52.4%), Infectious Diseases (44.8%) and Parenteral Nutrition (32.6%). It was seen that institution ownership, private hospitals were 3.3 ($p<0.001$) times, more likely than public hospitals to have pharmacist CDTM. Likelihood of having CDTM was also positively associated with the population of the city in which the hospital was located as well as the number of beds in the hospital, with hospitals in larger cities and with a greater number of beds having a significantly higher chance of having CDTM as compared to smaller cities and hospitals. Physician support for CDTM was identified as both a barrier and a facilitator to CDTM.

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INTRODUCTION

Background

Collaborative drug therapy management (CDTM), is defined by the Alliance for Pharmaceutical Care as " a team approach to healthcare delivery whereby a pharmacist and prescriber establish written guidelines or protocols authorizing the pharmacist to initiate, modify or continue drug therapy for a specific patient." (www.ashp.org/DocLibrary/Affiliates/CDTM.aspx). CDTM, also referred to as collaborative practice, allows pharmacists to use their specific drug therapy expertise, to augment care provided by other collaborating medical professionals in order to improve patient outcomes (Scott et al. 2003). CDTM is characterized by an inter-disciplinary approach involving an agreement between patients and physicians to manage drug therapy regimens (Finley 2002), wherein "qualified pharmacists working within the context of a defined protocol are permitted to assume professional responsibility for performing patient assessments, ordering drug therapy-related laboratory tests, administering drugs; and selecting, initiating, monitoring, continuing, and adjusting drug regimens" (Anaya 2008).

History of CDTM

Prior to 1951, pharmacists had the legal right to prescribe drugs. After the Durham- Humphrey amendment of 1951 was passed, prescribing by physicians and

dispensing of drugs by pharmacists underwent a legal separation (Hammond, 2003). As part of the Durham- Humphrey amendment of 1951, pharmacists were prohibited from refilling prescription drugs without physician authorization (Marks, 1995; Swanns 1994). These changes were implemented to improve patient safety since, according to the law, any drug that could have harmful effects or cause dependency could only be dispensed by a health practitioner on receipt of a prescription. This was done in order to prevent patients from abusing medications and it launched the beginning of the collaborative practice approach in which pharmacist services are integrated with services provided by other health care providers such as physicians and nurses to offer drug therapy management to patients (Marks 1995). The main rationale for the collaborative practice approach was providing patients with more efficient care and of better quality (Hammond, 2003).

The first CDTM program in the country was developed by the Indian Health Service. In 1973 a grant was used to set up the Pharmacist Practitioner Program under which pharmacists who had received the required training could collaborate with physicians to provide drug therapy management services such as patient monitoring between patient visits (Hammond 2003). This allowed physician visits to be spaced out more (Erickson 1977). Under the Health Manpower Experimental Act of 1972, allied health professionals in California were allowed to shoulder additional responsibility under collaborative agreements (California Assembly Bill 1971-1984). From 1981 to 1994, California underwent a series of legislative changes, which ultimately resulted in granting all pharmacists practicing in California-licensed acute and intermediate health care facilities, clinics and managed care organizations, authorization to provide drug

therapy management. This allowed pharmacists to perform activities like adjusting drug dosage, ordering laboratory tests, performing physical assessments, and administering drugs and initiating drug therapy (California Assembly Bill 1971-1984). In 1979, the state of Washington became the second state to authorize pharmacist participation in drug therapy management under the guidelines of a written protocol. As of 2013, pharmacists in Washington provide collaborative care community pharmacies, hospitals and managed care clinics (Christensen 1993).

The American College of Clinical Pharmacy released a position statement in 1997 supporting the use of pharmacist collaborative drug therapy management (CDTM) to improve the quality of patient care (Punekar 2003). As of 1997, when the position statement was released, sixteen states had already passed laws that enabled pharmacist participation in drug therapy management through collaborations with physicians and other providers (Punekar 2003). This number had expanded to thirty-eight states by the end of 2002. The Practice Advisory on Collaborative Drug Therapy Management, which was approved by Academy of Managed Care Pharmacy in February 2012, stated that forty-seven states had collaborative drug therapy management (CDTM) legislation or regulations (Weaver 2013). As of 2014, forty-eight states as well as the District of Columbia have laws allowing CDTM (Ryan 2014).

Pharmacist Scope of Practice

The role of the pharmacist has evolved to include patient education, drug therapy management, and pharmaceutical care, which are all facets of CDTM (Finley et al. 2002). Finley notes that the importance of having drug therapy experts is highlighted

when the increasing complexity of medication prescribing and the risk of adverse events due to drug interactions and medication errors are considered (Finley et al. 2002).

The American Society of Health-Systems Pharmacists supports the CDTM approach to care (Giberson et al. 2011). In the CDTM model, the physician is solely responsible for the diagnosis of a patient condition, while collaborating with the pharmacist to develop a specific management plan for an individual patient. In this way, the responsibility for the care of the patient is shouldered by both the physician and the pharmacist (Scott et al. 2004). According to the American Pharmacists Association, the activities performed by pharmacists under CDTM include initiating and modifying drug therapy, ordering and evaluating the results of laboratory tests, changing frequency of administration of drugs, adjusting drug dosage, and providing immunizations (Giberson et al. 2011). In addition to the above, most pharmacists are also able to contribute to CDTM by performing medication and patient drug history reviews and performing physical assessments related to drug therapy, which include checking their vital signs (Practice Advisory on Collaborative Drug Therapy Management, AMCP) (Scott et al. 2003).

Legal Requirements for CDTM

Since implementation of CDTM includes pharmacist duties sometimes considered to be outside their normal scope of practice, each individual state has been required to pass legislation that governs the extent and scope of CDTM in that state (Finley et al. 2002). The Practice Advisory on Collaborative Drug Therapy Management, which was approved by Academy of Managed Care Pharmacy in February 2012, stated that forty-

seven states had collaborative drug therapy management (CDTM) laws at that time (Weaver 2013).

Literature Review

Need for CDTM

Approximately fifty percent of the U.S. population takes a minimum of two medications every day with the Medicare population taking an average of over four medications each day (Menighan 2013). Adverse drug events account for over one hundred thousand deaths per year and are the fourth leading cause of death in the US (Menighan 2013). Medication errors exceed two and a half million dollars a year and cost over hundred and seventeen billion dollars (Menighan 2013). Menighan argues that prior investigators have reported that patients are more satisfied with the care provided to them when the health care team includes a pharmacist. Menighan also states that prior studies have reported improvement in patient outcomes as well as reduction in health care costs when a pharmacist was included in the health care team. (Menighan 2013).

According to Carmichael et al, CDTM is beneficial to physicians since CDTM results in a decrease in the number of visits for patients of chronic diseases and allows physicians to invest more time in establishing patient relations and managing difficult and complicated cases. Carmichael states that CDTM allows delegation of medication management to the pharmacist, who has the required skills and knowledge to support the physician's therapy strategies (Carmichael et al. 1997). He also posits that CDTM results in greater access to health care in the form of enhanced patient care via

pharmacist-physician collaborations, which has been reported to result in decreased drug-related problems and reduced costs to the healthcare system (Carmichael et al. 1997).

Impact of CDTM on Therapeutic Outcomes

Several studies focusing on patients with congestive heart failure have reported benefits from CDTM (Gattis 1999; Kalisch 2010; Duncan 2006) . Gattis and colleagues estimated the contribution of a pharmacist towards treating heart failure patients. They determined if there was any decrease in patient mortality as well as the number of heart failure related events when a pharmacist was added to the heart failure management team of patients in clinic (Gattis et al. 1999). The study utilized one hundred eighty-one heart failure receiving clinic based treatment. All the participants were randomly assigned to either an intervention group or a control group. Patients in the control group received standard physician-provided care, while patients in the intervention group also received pharmacist care in addition to physician care. This included drug therapy, making recommendations to the doctor, educating the patient about their health, and conducting follow-ups. Gattis reported a significant reduction in patient mortality and heart failure events in the group receiving CDTM care as compared to the group receiving usual care. Other positive outcomes reported in the study were an increase in the number of angiotensin-converting enzyme inhibitor doses as well as increased use of vasodilators to treat resistant patients in the group that received pharmacist care in addition to patient care (Gattis et al. 1999).

A randomized clinical trial that focused on patients who were admitted to hospitals with heart failure reported a significant decrease in the number of new patient admissions to the hospital, a reduction in the total days the patient stayed in the hospital,

as well as improved compliance with treatment for patients that had been provided post-discharge care in the form of an interview with a pharmacist both on the day of discharge as well as on a monthly basis thereafter. This lasted six months post-discharge (Kalisch et al. 2010).

There have also been several reports of positive outcomes associated with pharmacist involvement in diabetes education, with Duncan reporting that patients with diabetes see their pharmacists seven times more often than they see their primary care physician (Duncan 2006). Patients with Type-2 diabetes at The El Rio Health Center were provided care by a PharmD instead of a physician, only when the patients were referred to the residency-trained pharmacist by a physician (Leal et al. 2004). The pharmacist evaluated patients, made recommendations, prescribed medication and ordered laboratory tests (Leal et al. 2004). Diabetes outcomes assessed by the pharmacist included reduction in A1C levels, which refers to the level of hemoglobin A1C in the blood and is used as a way of estimating the average blood sugar concentrations for the patient in the previous two to three months.. Compared with the patient's original A1C levels, Leal et al.reported statistically significant reduction in LDL (low-density lipoprotein) cholesterol levels, blood glucose levels, mean A1C levels and blood pressure values. The number of patients that had achieved their targeted A1C levels went up almost seven times, while the number of patients that had reached their goals for hypertension and LDL cholesterol levels increased by twenty-four and seventeen percent respectively (Leal et al. 2004). Aspirin and ACE inhibitors (or angiotensin-converting-enzyme inhibitors) were used for the treatment. The use of aspirin increased by fifty - three percent, and the use of ACE inhibitors showed a twenty-five percent increase,

leading the authors to conclude that inclusion of clinical pharmacists in health care teams for diabetes patients had a positive effect (Leal et al. 2004).

Gerber et al. assessed the impact of three CDTM based models labeled Control, State, and Kaiser, on medical costs, which the study defined as the cost of treatment for patients in two years. This study was conducted for diabetes patients receiving treatment at Kaiser Permanente of Southern California (Gerber et al. 1998). In the Control model, pharmacists interacted with patients only on a need basis or by request. In the State model the pharmacists counseled patients on drug therapy, and the Kaiser model had pharmacists perform medication reviews, assess adherence as well as educate patients about their disease and drug therapy (Gerber et al. 1998). Both models that included a pharmacist in the team reported significant decrease in costs incurred when compared to model that didn't have a pharmacist. The Kaiser model where pharmacists reviewed drugs and provided patient education reported a 21.9 percent reduction in direct medical costs. The State model where the pharmacist only provided prescription counseling had a 9.9 percent decrease in costs as compared to the control model (Gerber et al. 1998).

A 2002 retrospective cohort study that compared the control of blood glucose levels in patients with Type 1 and Type-2 diabetes in a clinic that was physician-supervised but managed by a pharmacist, to patients that received standard physician care in the same clinic. The study reported that the risk having an A1C level (value measuring the level of blood sugar in blood over the last the months) of at least seven percent was significantly greater in the group that only received physician care as opposed to the group that received both pharmacist as well as physician care (Irons 2002). The physician-managed group also had a higher number of diabetes-related clinic visits per

patient per year leading the authors to conclude that pharmacist-managed diabetes care had been effective in improving patient outcomes in diabetes patients by improving glycemic control without causing an increase in the number of clinic visits (Irons 2002).

A 2013 prospective, multi-center cohort study by Farland and colleagues assessed the effect of providing patient care to diabetes patients under a pharmacist-physician collaborative agreement. The study was based in seven practice sites in Tennessee and measured the level of glycemic control that was achieved by Type 2 Diabetes patients who were provided care under the collaborative agreement. (Farland et al., 2013). The terms of the collaborative agreement were fixed prior to the commencement of the study. The study included patients who were over 18 years old and had a life expectancy that was more than one year. These patients were followed for twelve months (Farland et al., 2013). Primary outcomes assessed in two hundred and six mostly male patients averaging sixty years of age included hemoglobin A1C (A1C is a value measuring the level of blood sugar in blood over the last the months), number of patients who had A1C levels that were lower than seven percent and the number of patients that had A1C levels which were greater than nine percent. The study reported a reduction of around one percent in A1C levels while the percentage of patients whose A1C levels were lower than seven percent increased from 12.75 percent at the beginning of the study to 36.76 percent at the end of the twelve month follow-up period The study concluded that involving pharmacist in collaborative care for diabetes patients without increasing the medications had a positive effect on improving blood glucose control and diabetes control without any corresponding increase in self-reported hypoglycemic events (Farland et al., 2013).

Similar results were seen in a study that evaluated the impact of pharmacist management of patients with diabetes mellitus enrolled in a new pharmacist service at a rural free clinic (Sease, Franklin, & Gerrald, 2013). The study included ninety-five patients over eighteen years of age who qualified for free care and had a diagnosis of Type-2 diabetes. Study participants were given diabetes education, lifestyle modification counseling and managed drug therapy under a collaborative practice agreement between physicians and pharmacists. The study was conducted over twenty-four months. The outcomes assessed were changes in A1C levels, blood pressure levels and lipid levels (Sease et al., 2013). The study also reported that **s**ignificant reductions in Hemoglobin A1C values, blood pressure levels (both systolic and diastolic) LDL cholesterol levels, as well as triglyceride levels were seen in patients who received care under CDTM, when compared with their original values at the beginning of the study period (Sease et al., 2013). Using cost estimates from literature that reported expected savings of $1,118 per patient for those patients that showed more than a one percent lowering of A1C values, the pharmacist service was estimated to provide savings to the tune of seventy five thousand dollars in one year.

Patients in six were provided care under Physician-Pharmacist CDTM for blood pressure control. The blood pressure levels of these patients after 24 hours of receiving treatment were compared (Chen, Ernst, Ardery, Xu, & Carter, 2013). The six clinics in the study were randomly assigned to two groups based on whether they were under CDTM care (three clinics, hundred and seventy-six patients) or under a physician only (three clinics, hundred and ninety-eight patients) (Chen, Ernst, Ardery, Xu, & Carter, 2013). The authors reported significantly lower mean blood pressure levels in the

pharmacist-physician managed group. According to the study, collaboration between physicians and pharmacists also resulted in an increase in the use of antihypertensive drug therapy for patients in the group provided with care under CDTM as compared with the group that received usual care (Chen et al., 2013).

A series of studies based in North Carolina, known as the Asheville project, showed significant improvement in outcomes when community pharmacists trained in diabetes care began participating in collaborative care (Cranor et al. 2003). This was demonstrated via a longitudinal study based in twelve community pharmacies in Asheville, N.C.. This pre-post cohort study assessed the effects of adding a community pharmacist that had received diabetes treatment certification and was getting reimbursed for providing Pharmacist Collaborative Services to the health care management team for patients with diabetes (Cranor et al. 2003). Changes in glycosylated hemoglobin (A1C), which is the value measuring the level of blood sugar in blood over the last the months, were measured. The study also measured any changes in the cost of treatment for the patients as well as utilization of the pharmacist and the physician. Mean A1C values showed a decrease at each of the follow-ups. The number of patients with that achieved target A1C levels also went up in each follow-up (Cranor et al. 2003). Average direct medical costs showed a decrease of twelve hundred dollars for each patient in one year. The increases in worker productivity resulting from this were reported to be worth $18,000 per year (Cranor et al. 2003).

Prior studies in literature have reported an improvement in patient outcomes when anticoagulation therapy is managed by a trained and experienced pharmacist as opposed to when anticoagulation therapy is provided by physicians in the standard way.

(Young et al. 2011; Stafford et al. 2011). A 2006 retrospective cohort study by Young and colleagues compared an anticoagulation program that was managed by a pharmacist to a program in which patients received the standard care from physicians. The study was based in a clinic for family medicine. One hundred and twelve patients on warfarin in the pharmacist-managed group were compared to eighty-one patients in the physician managed group. The study was conducted over a seventeen month period. The study assessed outcomes in terms of outcomes such as the percentage of time the patients' international normalized ratio stayed inside the recommended therapeutic range, the percentage of time that the patients' normalized ratio was reported to be within the expanded range and the percentage of time the international normalized ratio was either greater than five or less than one point five (Young et al. 2011). The study reported that the percentage of time the patients' international Normalized Ratio was in therapeutic range was seventy-three percent for the pharmacist managed group and sixty-five percent for the other group that was only getting physician care. This was a significant increase (Young et al. 2011). The authors concluded that the study findings proved that patients receiving care from pharmacists achieved significantly better outcomes compared to patients receiving physician care only.

Impact of CDTM on Economic Outcomes

Several studies have reported evidence that having a pharmacist involved in direct patient care activities can decrease costs associated with medication errors. In 1995, Johnson and Bootman estimated that almost sixty percent of the direct costs of drug-related adverse effects and patient deaths could be saved with pharmacist intervention (Johnson and Bootman. 1995). Pharmacists collaborating with providers in the long-

term care setting have been reported to be effective in preventing medication errors (Grissinger, 2003; Giberson et al. 2011), and hence could contribute towards reducing the costs associated with medication problems which has been estimated to be 3.5 billion dollars (National Academies Press; 2007:124-25). Studies that focused on the US Department of Veteran affairs have reported that for every dollar that is used for adding a clinical pharmacist to the health care management team, the benefit accrued in greater than four dollars (Manolakis et al. 2009). Patel et al. extrapolated average salary data for pharmacists and projected $368,000 savings benefit from providing clinical pharmacy services for each clinical pharmacist. (Patel RJ et al. 1999) . Six hundred recommendations to physicians by pharmacists in hospital settings were studied and it was reported that around ninety percent of the recommendations were accepted by physicians leading to better health outcomes in about a third of the patients in each setting. The mean cost avoidance for all the recommendations was calculated to be seven hundred dollars each resulting in savings to the tune of four hundred thousand dollars (Lee et al. 2002). The Asheville project that assessed the economic impact of providing CDTM based drug therapy management to patients with Asthma found that savings in direct costs that resulted from providing collaborative care to pharmacists were approximately seven hundred and twenty five dollars per patient for each year, while indirect medical costs reduced by around twelve hundred dollars per patient per year (Cranor et al. 2003).

The 2013 study by Sease and colleagues that assessed the impact of providing pharmacist managed patient care to ninety-five patients with Type-2 diabetes at a free rural clinic also used published cost estimates to calculate the economic impact of the

collaborative practice intervention in terms of expected savings for each patient who had a decrease of more than one percent in HbA(1c) value (Sease et al., 2013). The study reported that the addition of physician-pharmacist collaborative service resulted in savings estimated at $74,906 per year. This figure was calculated using an expected savings rate of $1,118 per patient who had a decrease of more than 1 percent in HbA(1c) value (Sease et al., 2013).

Perceptions of CDTM

Pharmacists

Scheerder conducted a survey of two hundred community pharmacists and reported that pharmacists are more satisfied with their professional activities when they are involved in patient-centered services as opposed to product-oriented activities (Scheerder 2008). Pharmacists were found to generally have a very positive attitude towards participating in depression care (Scheerder 2008).

Pharmacy directors surveyed in 2003 demonstrated a positive attitude towards CDTM, specifically in terms of the support they felt CDTM had from health care providers and hospital administrators (Thomas et al. 2006). They expressed that they felt that the impact of CDTM was strategic, not financial, with directors in hospitals with CDTM placing greater value on the strategic impact of CDTM compared to directors in hospitals without CDTM. They also viewed CDTM as being strategic in terms of increasing the value of pharmacists for upper administration (Thomas et al. 2006).

A 2013 study assessing physician and pharmacist views on collaborative practice used two separate questionnaires that were sent out to community pharmacists and family

physicians. Both surveys contained questions on attitudes towards CDTM , respondents' past experience with CDTM, perceptions of pharmacist contribution to CDTM, disease/treatment areas in which collaborative practice could be expanded and barriers to the adoption of CDTM (Kelly et al., 2013) The survey had a very high response rate of over seventy-six percent from pharmacists and it reported that pharmacists main expectations from CDTM was the opportunity to be able to identify and treat any problems patients face due to drug therapy. This differed from the physician response to the survey. Physicians as well as community pharmacists surveyed in the study were of the opinion that CDTM could greatly improve patient outcomes. Both groups also felt that the major barriers to the implementation of collaborative practice agreements were shortage of time, lack of compensation, and the problems associated with having to work with multiple pharmacists or physicians (Kelly et al., 2013).

A 2008 study by Murawski and colleagues assessed pharmacist perceptions of CDTM in the states of New Mexico and North Carolina (Murawski et al., 2011). The survey was answered by 189 certified pharmacist clinicians, a majority of whom were based in community or institutional settings, most often hospital clinics or physician offices. It was reported that over ninety percent of the respondents surveyed indicated that patients were “a great deal” satisfied with services provided by advanced-practice pharmacists and around eighty-five of the respondents felt that physicians were “a great deal” satisfied with their services. Half of the respondents were of the opinion that their organization’s administration was “a great deal” satisfied with their services. Pharmacists also believed their services to be providing economic benefit to the patients (eighty-three percent of the respondents felt they were saving money for their patients),

while over ninety percent of the participants felt that they were decreasing costs for the government (Murawski et al., 2011). Around eighty percent of the pharmacists believed that their services had resulted in "a great deal" of improvement to patient outcomes. However, in spite of the general view that CDTM was improved patient outcomes, around thirty-eight percent of the pharmacists surveyed said they were required to justify the implementation of collaborative practice (Murawski et al., 2011).

Physicians

Studies focused on physician attitudes towards CDTM have yielded contradictory results. In 2009, A mail survey was carried out for a random sample of five hundred physicians based in West Virginia. The survey used included questions on the physicians' opinions about the activities performed by pharmacists, the level to which they were comfortable with pharmacists providing certain Medication Therapy Management (MTM) services, and their general attitudes towards a CDTM agreement with pharmacists. More than half of the sample had a positive attitude toward CDTM. However they had a more negative outlook on the pharmacists' role in CDTM and Medication Therapy Management (MTM). Most physicians surveyed reported being comfortable only with letting pharmacists perform specific activities Medication Therapy Management (MTM) services. These activities included providing patients with drug education, and identification of medication errors (Alkhateeb et al. 2009). On the other hand, Airmet et al. reported that physicians tend to have consistently more negative views about pharmacists providing clinical pharmacy services, providing pharmaceutical care, and engaging in collaborative drug practice agreements than pharmacists (Airmet et al. 2001).

A 2013 study assessing physician and pharmacist views on collaborative practice used two separate questionnaires that were sent out to community pharmacists and family physicians. Both surveys contained questions on attitudes towards CDTM , respondents' past experience with CDTM, perceptions of pharmacist contribution to CDTM, disease/treatment areas in which collaborative practice could be expanded and barriers to the adoption of CDTM (Kelly et al., 2013). Though the survey had a very low response rate from physicians at seven percent, the respondents to the physician survey favored an increase in collaboration for insurance approvals, patient counseling, and improved patient adherence. The study results showed disagreement between physicians and pharmacists in terms of the disease/treatment areas for care provided under CDTM. However the low response rate for the physician survey as opposed to the pharmacist survey makes it difficult to generalize these findings to all physicians. (Kelly et al., 2013)

A study in 2011 study compared the effectiveness of providing care under CDTM, where pharmacists, under the supervision of a physician, ordered laboratory tests and changed drug strength, to providing only physician care the for patients taking lipid-lowering medication (Lalonde et al., 2011). The study also assessed the opinions of physicians, pharmacists, and patients regarding the collaboration as well as the kind of care provided. The authors stated that physicians were of the opinion that collaborating with pharmacists was necessary due to shortage of physicians. However they claimed to be unsure of how such a collaboration would affect their patient relations (Lalonde et al., 2011).

A cross-sectional study of Michigan office-based physicians conducted by Kucukarslan and colleagues assessed physician beliefs about CDTM, their general attitude towards collaborating with pharmacists, and their plans for establishing collaborative agreement with community pharmacists to provide drug therapy to patients (Kucukarslan, Lai, Dong, Al-Bassam, & Kim, 2011). A total of eleven hundred and nine physicians were sampled, with the response rate being approximately thirty percent. The findings of the study indicated that physicians' were of the opinion that providing patient care under a collaborative agreement with a community pharmacist would improve medication adherence in patients that received this care. The study found that physicians who believed that collaborative practice would improve patient outcomes were more likely to participate in CDTM. According to the study results, physician beliefs and attitudes toward collaborative practice was associated with their decision to participate in collaborative care (Kucukarslan et al., 2011).

Patients

Patients with dyslipidemia who were enrolled in a study by Lalonde and colleagues were found to be highly appreciative of the pharmacist contribution to their health care team (Lalonde et al., 2011). Most patients in the study reported feeling that satisfied with the follow-ups that were conducted. Patients also reported that the re-assurance and information received from pharmacists during follow-up had increased their desire to take better care of themselves. The patients gave maximum credit to the pharmacists' communication skills as well as ease of access for their positive feelings towards their health care management (Lalonde et al. 2011).

Patients in the diabetes portion of the Asheville Project were surveyed at baseline as well as eight and fourteen months after enrollment about their satisfaction with pharmaceutical care services (Cranor et al. 2003). Patients were asked to rate their satisfaction with the pharmacists, the pharmacists' explanation of drug therapy, the pharmacists' technical competence, and the courteousness of the staff. Satisfaction scores were seen to improve during the study, indicating that the patients were more satisfied with the quality of care that was provided from when CDTM was incorporated into their care.

Facilitators of CDTM

There has been limited research focused on identifying facilitators of collaborative drug therapy management, however a 2003 survey of pharmacy directors identified physician and other medical staff support, advanced education and training of pharmacists, upper administration support, and pharmacists' desire to participate in CDTM as the most salient facilitators of CDTM (Thomas et al. 2003).

In 2008, Murawski and colleagues surveyed 189 pharmacist clinicians and pharmacist practitioners in North Carolina and Mexico to assess their views on practice sites for CDTM, reimbursement issues and types of protocols used for collaborative practice (Murawski et al. 2011). The survey had a response rate of thirty-four percent with the majority of survey participants practicing in community or institutional settings, most often hospital clinics or physician offices. The respondents to the survey were asked to identify which factors they felt were most responsible for successful program implementation at their institutions. Key factors in program success cited by survey

participants in decreasing order of importance were provider support and “buy-in”, reporting of health outcomes data, the reporting of financial metrics, patient acceptance and buy-in administrative support, proper workload balance, a demonstrated need for services, the personal drive of the pharmacist, cost neutrality for the institution, training and certification, a manageable number of targeted disease states and a balanced patient caseload (Murawski et al., 2011).

Barriers To CDTM

A lack of education in mental health issues was identified as the main barrier to pharmacists providing collaborative care to patients with depression by over seventy-five percent of pharmacists surveyed (Scheerder 2008). Other frequently reported barriers were shortage of time to spend with patients, insufficient patient and treatment information, difficulty finding a private setting in the pharmacy to conduct patient interviews as well as problems with talking to patients with depression (Scheerder 2008).

A 2013 study by Kelly and colleagues stated that both physicians and pharmacists surveyed by the study chose the lack of time and compensation for collaborative activities as well as the difficulty caused by needing to work with multiple pharmacists and physicians as the main barriers to widespread adoption of CDTM (Kelly et al. 2003).

A major hurdle to the adoption of CDTM practices in general has been perceived to be "turf wars" between physicians and pharmacists (Airmet 2001 ; Murawski 2011; Thomas 2003). In 2001, Airmet and Adamcik reported that physicians consistently had more negative views about pharmacists providing clinical pharmacy services, providing

pharmaceutical care, and engaging in collaborative drug practice agreements than did pharmacists (Airmet et al. 2001). In 2003, Thomas et al. conducted a survey of a pharmacy directors which asked them to identify what they perceived to be the major barriers to CDTM. As per the study findings, insufficient number of pharmacists and less support from physicians and medical staff were the most commonly cited barriers (Thomas et al. 2003).

The 2008 survey of pharmacists in North Carolina and New Mexico assessed the main implementation barriers to CDTM as identified by pharmacists (Murawski et al., 2011). Some major barriers identified were issues with acceptance, reimbursement challenges, administrative issues, patient acceptance and awareness, lack of previous program experience, legislation or regulations, cost issues, space issues and time constraints (Murawski et al., 2011). Further pitfalls to avoid while implementing a collaborative practice were identified to be inadequate planning, poor choice of disease concentration, "turf wars," improper billing methods, performance of extra duties as a part of normal pharmacy practice, supervisors' lack of clinical experience, financial problems, and failure to use the facility's electronic medical record (Murawski et al., 2011).

Extent of Pharmacist Practice

Forty-eight states have passed legislation permitting some form of collaborative practice, meaning that each state has individual state pharmacy laws that allow pharmacists to "initiate, modify, and/or discontinue drug therapy pursuant to a collaborative practice agreement or protocol" (Giberson et al. 2011). Some states

specifically address CDTM in their state practice acts while others do not (Giberson et al. 2011). According to the American Pharmacists Association, the services provided by pharmacists across the country has been increasing in scope via CDTM agreements between pharmacists and other health care professionals (Weaver 2013). These agreements signify a formal partnership between pharmacists and health care professionals who are mostly physicians, and permit drug therapy management to take place in a collaborative setting (Weaver 2013).

As per a report published by the APhA (American Pharmaceutical Association) and the National Alliance of State Pharmacy Associations (NASPA), as of 2013, 47 states and the District of Columbia allow for CDTM, including the state of Tennessee which allows for physician-pharmacist collaboration in spite of not having a collaborative practice agreement (CPA) provision in the state law (Weaver 2013).

The scope and extent of the pharmacist services, including any limitations on practice sites and disease/treatment categories, ability to order laboratory test and eligibility requirements for pharmacist participation, differs greatly even among states with collaborative practice agreement provisions (Weaver 2013; Giberson et al. 2011). Krystalyn Weaver of the American Pharmaceutical Association (APhA) foundation reported on findings from a new analysis by the APhA and the National Association of Specialty Pharmacy regarding current Collaborative Practice Agreement legislation across the country that state that in 2013 thirty-three states plus the District of Columbia allowed pharmacists to participate in initiating drug therapy (Weaver, 2013). Weaver states that eight states exclude community pharmacies from the practice sites that have collaborative practice authority, thirty-one states allow ordering and interpretation of

laboratory tests, six states mention only specific disease states that can be included in the collaborative practice agreement, and "many more" have legislation that makes it mandatory for the agreement to be disease-state specific for each patient (Weaver, 2013). The report also states that "many" states allow pharmacists to discontinue drug therapy while "nearly all" the states with collaborative practice agreement provision allowed pharmacists to modify drug therapy, but the actual figures for both these services were not forthcoming (Weaver, 2013).

In 2003, Thomas et al. conducted a comprehensive survey to gauge the extent and scope of collaborative drug therapy management (CDTM) in U.S. hospitals as well as assess pharmacy directors' opinions regarding the effects of CDTM, regulations affecting CDTM and financial impact of CDTM (Thomas et al. 2006). It was reported that approximately half of the respondent hospitals had some pharmacists engaged in collaborative practice. Most respondent hospitals that had any kind of CDTM had pharmacists involved in ordering laboratory tests (84.2 percent), adjusting a drug's strength (86.7 percent), and changing a drug's frequency of administration (81.6 percent). Only 12.7 percent of hospitals with CDTM reported charging a fee for the CDTM services provided.

In 2008, Murawski and colleagues surveyed 189 pharmacist clinicians and clinical pharmacist practitioners in North Carolina and Mexico to elicit information on practice settings, billing and reimbursement methods, collaborative drug therapy management (CDTM) protocols, and other issues (Murawski et al., 2011). The survey had a response rate of 34 percent, with the majority of survey participants practicing in community or institutional settings, most often hospital clinics or physician offices. At

the time of the survey, about eighty percent of the respondents were found to be engaged in a CDTM protocol. The study also asked the respondents to identify specific activities they were participating in as covered under the protocol. Of the 189 respondents, 21 pharmacists (32.8%) reported having prescribing authority; while eight respondents (12.5%) indicated that they had the ability to order laboratory tests and other procedures to help manage patients. Around seven percent of the respondents indicated that the governing protocol at their institution was specific to a particular disease state with 5.5 percent of the patients indicating that protocol-specified guidelines followed the North Carolina Board of Pharmacy guidelines and 1.6 percent reporting that the protocol required them to document all patient encounters (Murawski et al. 2011).

The main disease states where the pharmacists were involved in some kind of collaborative practice were identified by the respondents to be diabetes (approximately sixty percent), coagulation or lipid disorders (approximately fifty-five percent), hypertension (approximately forty-seven percent), chronic obstructive pulmonary disease (COPD) (approximately twenty-three percent), pain (approximately twenty percent), and heart failure (less than twenty percent) (Murawski et al. 2011).

The 2012 national American Society of Health-System Pharmacists survey of pharmacy practice in U.S. hospital settings was a mail survey that was conducted for a stratified random sample of pharmacy directors at approximately fifteen hundred general hospitals and children's hospitals (Pedersen, Schneider, & Scheckelhoff, 2013). The survey reported a response rate of 34 percent. It was seen that the rate of pharmacist monitoring of approximately 75 percent of the patients in the hospitals surveyed had more than doubled from 2000 to 2012. It was further reported that

collaborative drug therapy management programs were present at most hospitals with pharmacists at more than 80 percent of the hospitals participating in the ordering of laboratory tests and adjusting drug strength. Pharmacists routinely performed discharge counseling in around a fourth of the hospitals that responded to the survey (Pedersen et al., 2013).

Objectives

The overall objective of the project was to study the extent and scope of collaborative drug therapy management (CDTM) in U.S. hospitals as well as pharmacy directors' perceptions regarding CDTM. The specific objectives of this study were to

1) Assess the current extent, scope and perceptions of CDTM in U.S. hospitals,

2) Determine the associations between hospital characteristics, pharmacy director characteristics, and perceptions of CDTM

3) Investigate hospitals' short-term and long-term plans regarding CDTM

4) Identify pharmacy directors' views about the major facilitators and barriers for CDTM in hospitals.

Project Significance

The scope of Pharmacy Practice has expanded over the last ten years (Giberson et al. 2011 ; Taylor 2008). A report to the US Surgeon General in 2009 states that after a patient has received a confirmed diagnosis, the patient health care team generally includes several pharmacists that help the patient to manage their disease and also deliver patent care services as health care providers in the United States (Giberson et al. 2011).

However, according to George Halvorson, chairman and CEO of the Kaiser Foundation Health Plan, Inc. clinical pharmacists are still "the most underutilized members of the health care team" (Giberson et al. 2011).

Data are limited regarding the actual number of pharmacists who are engaging in CDTM and the kind of services they provide, with prior literature primarily focusing on the legal ability of pharmacists to participate in CDTM without looking at empirical evidence to see the actual practices being implemented in health care settings. There is a need for current data on the extent to which CDTM is being implemented in hospitals.

Measures have been taken to address the barriers to CDTM, as have been identified previously, with pharmacy education engaging in widespread curricular change to better prepare graduates to assume increased responsibility for patient care. The minimum required qualification for a pharmacist has been has been elevated from a BS in Pharmacy to a Doctor of Pharmacy (Giberson et al. 2011). The number of years required to obtain a Doctor of Pharmacy degree has also gone up over the years, from the original four years to a minimum of six years, which is the current requirement. Giberson states that the time invested in getting a Doctor of Pharmacy degree and the intensity of the program is at par with the education received at dental school and is ahead of the kind of training received by most other health care providers (barring physicians) (Giberson et al. 2011).

Respondents to a survey in a 2001 study by Airmet and colleagues focusing on pharmacist and physician views of collaborative practice chose "turf wars" between physicians and pharmacists as the main barrier to the adoption of collaborative practice (Airmet et al. 2001). However there have been several recent studies that report contrary

findings. Of these, the 2008 respondent-driven survey Clinical Pharmacy Specialist (NCPS) Program within the U.S. Public Health Service, which was answered by 117 physicians representing 13 states, presented the most decisive findings in favor of physician-pharmacist collaboration. All the data was sourced from facilities that practice CDTM and in 87.2 percent of the cases, the physician had worked or was currently working with a NCPS recognized pharmacist. Ninety-six percent of physicians surveyed reported some benefits, including an improvement in health outcomes, increased productivity, more time to focus on complex and critical cases instead of chronic disease patient and improved access to access to care for patients. Eighty-eight percent of the surveyed physicians felt that including pharmacists in the collaborative practice had improved primary care (Giberson et al. 2011). So there is evidence of a change in trend regarding physician attitude towards CDTM which would merit further investigation. However there is still need to investigate the nature of this collaboration as is currently being practiced, as there is a dearth of literature in this regard. This project seeks to serve that need.

To summarize the findings from the previous paragraph, there seems to have been a substantial change in the practice as far as evidence regarding physician approval of pharmacist collaboration is concerned (Giberson et al. 2011). There has also been steady growth in the number of state laws and regulations enabling pharmacists to engage in CDTM. In 1996, Shefcheck and Thomas reported that 16 states had laws authorizing pharmacists to initiate and modify drug therapy in concert with prescribers, and 16 other states were pursuing such laws (Shefcheck and Thomas, 1996). Twenty-one states had pharmacist CDTM laws by 1998 (Ferrko et al. 1998), which increased to 32 states in

2003 (Punekar et al. 2003). As of 2012, 47 states allowed some form of collaborative practice (Giberson et al. 2011). However, little data is available on the extent and scope of CDTM occurring in U.S. hospitals. Assessing the current opinions of pharmacy directors on various aspects of CDTM can help the pharmacy profession identify factors that act as potential barriers or facilitators to the growth of CDTM.

In this study, we explored the extent and scope of collaborative drug therapy management (CDTM) in U.S. hospitals and also identify pharmacy directors' perceptions regarding CDTM. There is little data available on the extent to which CDTM is being implemented in U.S. hospitals. Also, assessing the current opinions of pharmacy directors on various aspects of CDTM can help the pharmacy profession identify factors that act as potential barriers or facilitators to the growth of CDTM.

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METHODS

Study Design and Setting

A cross sectional research design, utilizing a self-administered written survey was adopted to address the study objectives, which were to assess the extent and scope of CDTM in U.S. hospitals and identify pharmacy directors' opinions on CDTM. The survey questionnaire was administered to a random national sample of hospital pharmacy directors. A written study protocol was submitted to the Purdue University IRB center for approval before the initiation of the research.

The Survey Instrument

A mail survey developed and validated by Thomas et al. (Thomas et al. 2003) was used to collect data. The mail survey asked respondents to indicate whether any pharmacists in their hospital are engaged in CDTM or collaborative practice that involves the initiation or modification of drug therapy. It contained questions on the respondents' views about CDTM, the extent and scope of CDTM activities in their institution, their long and short term plans involving CDTM, as well as demographic data on the pharmacy directors and hospital characteristics. The survey also had two additional open-ended questions that asked the respondents what they perceived to be the greatest

barrier to CDTM as well as the greatest facilitator of CDTM. The survey used in the study is included in Appendix A.

The survey also contained twenty-seven items assessing respondents' opinions about the range and scope of practice in CDTM (six items), the support for CDTM by other health care providers and administrators in the hospital (nine items), the strategic value provided by collaborative practice to the pharmacy (three items), any financial value created by collaborative practice (five items), and nature of current state regulations that affect collaborative practice (four items). These twenty-seven items were further summed to form four scales: the support for CDTM scale (eight items), the strategic impact of CDTM scale (three items), the financial impact of CDTM scale (four items), and the regulations affecting CDTM scale (four items). The support for CDTM scale assesses pharmacy director perceptions about the support for CDTM activities from the hospital staff, including medical staff and upper administration (Thomas et al. 2003). The strategic impact of CDTM scale measured how collaborative practice has affected upper administration's perception of pharmacists and facilitated implementation of CDTM (Thomas et al. 2003). The financial impact of CDTM sub-scale measured perceived financial effects of collaborative practice, including reimbursement issues (Thomas et al. 2003), while the regulations affecting CDTM assessed pharmacy director perceptions of the range and scope of current regulations regarding CDTM. Respondents indicated their degree of agreement with each statement on a five-point Likert scale. Items regarding perceptions on CDTM that were negatively worded were reversed scored for analysis and scale scoring. Item ratings for each scale, namely the support for CDTM scale, the strategic impact of CDTM scale the financial impact of CDTM scale, and the

regulations affecting CDTM scale, are added to give a scale score. Each scale score is then divided by the number of items in the scale to obtain a score ranging from one to five. Scores close to one indicate strong disagreement and scores close to five indicate strong agreement with the perception.

The survey being used in this study was developed and validated in a previous study by Thomas and colleagues in 2003 (Thomas et al. 2003). To validate the survey, Thomas and colleagues evaluated the psychometric properties of the scales measuring respondents' opinions about CDTM. All items in each of the four scales, namely, the support for CDTM scale, the strategic impact of CDTM scale, the financial impact of CDTM scale, and the regulation affecting CDTM scale, were reported to have Cronbach's alpha's values that were greater than 0.7. Therefore the scale items were said to have good internal consistency. (Thomas et al. 2003).

Sample Size Determination

A stratified random sample of one thousand and twenty-six hospital pharmacies was selected from the hospital executives mailing list received from F1RSTMARK Hospital Executives. The mailing list included contact information for U.S. hospitals across the country which had Pharmacy Director information available. The estimated sample size was based on the binomial distribution, which generated a required sample of three hundred and twenty-one surveys to estimate the percentage of hospitals having CDTM when the error was within plus or minus five percentage points at a confidence interval of ninety-five percent. The probability of a hospital having CDTM was taken to

be 0.3. A response rate of approximately thirty percent was assumed. Dividing the required sample size by the expected response rate, nine hundred and sixty-three was calculated to be the number of surveys required to be mailed. One thousand and twenty six was chosen as the sample size to allow some margin for undeliverable questionnaires.

Sample Selection

The sample of hospitals was obtained from the hospital executives mailing list received from F1RSTMARK Hospital Executives. The mailing list included contact information for hospitals across the country for which Pharmacy Director information was available. Stratified sampling was used to determine the sample size for each state. The number of hospital pharmacies in fifty states was obtained from the guide. The number of pharmacies in each state was divided by the total number of pharmacies to obtain a sampling fraction or ratio for each state. Each fraction was multiplied by 1,026, the calculated sample size, to obtain the sample size for each state (appendix F).

Data Collection

The survey strategy was based on the Dillman method for mailed surveys (Table 1) that has been reported to improve response rate (Dillman, 2007). To maximize response rate, Dillman recommends that all prospective subjects be sent a personalized advance-notice letter informing them about the survey and the questionnaire they would be receiving shortly. Approximately one week later, a complete survey package with a cover letter, instructions, the questionnaire and including a return envelope with postage,

should be sent to the participants. A follow-up postcard that includes a thank you note as well as a reminder should be mailed out a week after that. Two weeks after mailing the follow-up postcards, a new cover letter, questionnaire, and return postcard is to be sent to those who have not, possibly by registered post, to request completion of the survey.

Advance notice letters informing the selected pharmacy directors about the survey they would be soon receiving were sent by first class mail on September 9, 2013. The script for the letter is included in Appendix B. Following the mailing of the advance notice letters, the questionnaires and cover letters for the first round of data collection were sent by first class mail on September 16, 2013 with "pre-paid postage" business reply covers. The questionnaire is included in Appendix A, while the cover letter used for the first round of data collection is included in Appendix C. The questionnaires were also numbered to keep track of receipts in order to eliminate follow up mailings to respondents that had already returned their questionnaires. As per schedule, a reminder cum thank you post card was sent to all the pharmacy directors in the original sample on September 23, 2013, a week after the first mailing of the surveys. The script for the follow-up post card can be found in Appendix D.

Two weeks after the first mailing, a hundred and twenty six questionnaires had been received and another eighty-four had been returned undelivered. The letters were returned if the pharmacy director could not be reached. The first follow-up survey package was mailed on October 7, 2013.

A second follow-up consisting of another copy of the questionnaire and a cover letter was mailed on November 11, 2013. For this mailing, the surveys that had been returned due

Table 1. Survey Mailing Schedule Based on Dillman Method for Mail Survey

Week	Task
Week 1	Mailed out personalized advance notice letters to prospective subjects informing them about the survey they will be receiving shortly
Week 2	Mailed a survey package containing a cover letter, instructions, the questionnaire and a return envelope with postage to the subjects
Week 3	Mailed a follow-up postcard that includes a thank you note as well as a reminder to all subjects
Week 5	Two weeks after mailing the follow-up postcards, mailed the survey along with a new cover letter and return postcard to the subjects who were yet to respond, requesting them to complete the survey

to change of pharmacy director or wrong address were re-addressed and re-mailed. At the end of the mailing cycle, a total of eighty-four questionnaires were still returned as undeliverable. A total of two hundred and ninety-five surveys were returned by the respondents and two hundred and eighty-three of these were considered usable. The net usable response rate was therefore calculated to be 30.1 percent.

Each respondent had a unique number assigned to them which was used to record survey data in lieu of personal information. This ensured that respondent confidentiality was maintained at all stages.

Statistical Analysis

Data management and analysis was be carried out using SAS for UNIX version 9.3 (SAS Institute, 2012) Cary, NC. An a priori alpha level of 0.05 was used for all analyses.

Hospital Characteristics

Frequency statistics were computed for demographic data on hospital characteristics, including institution ownership, institution classification, population of the city in which the institution was located, number of beds, and total number of patient days in the hospital in the past year.

Pharmacy Director Characteristics

Frequency statistics were computed for demographic data on pharmacy directors, including sex, age, degrees obtained, completion of a residency or receipt of any special

certification, and number of years since they had initially obtained a license to practice pharmacy.

Extent and Scope of CDTM in Hospitals

Based on the responses to the survey, the proportion of hospitals that authorize their pharmacists to engage in CDTM was calculated. The survey asked the respondents to list the total number of pharmacists employed at their institution as well as the number of pharmacists who are engaged in collaborative practice. This was used to calculate the proportion of pharmacists that are involved in CDTM. The survey asked pharmacy directors to record whether any pharmacist in their hospital is authorized to perform each of the following activities; adjust a drug's strength, order laboratory or related tests, change a drug's frequency of administration, discontinue a drug, and initiate drug therapy, was calculated. For hospitals that do have pharmacists involved in a particular CDTM activity, respondents are asked to further indicate if pharmacists participate in the these activity for all patients, or if they are authorized to carry out the activities for certain diseases and patients only. Based on these survey items, the percentage of hospitals with at least one pharmacist involved in each of the activities listed above was calculated. For hospitals that allowed CDTM for that particular activity, the proportion of hospitals that authorized the activity for all patients, as well as the proportion of hospitals that only allowed pharmacists to engage in that activity for specific diseases and patients were calculated.

The survey asked whether hospitals have written protocols for CDTM, the number of protocols for each hospital, and also the type of the protocols, i.e., whether the

protocols are treatment specific, disease specific or general protocols. Based on these survey items, the means and standard deviations for the number of protocols per hospital were calculated. The proportion of hospitals having written protocols was also calculated, as well as the distribution of the different types of protocols across hospitals (the number of treatment/disease specific protocols and the number of general protocols).

The survey also asked respondents to indicate the diseases and treatments for which pharmacists in their hospital engage in collaborative practice that involves initiation or modification of drug therapy. The respondents are asked to indicate the particular diseases/treatments for which the hospital authorizes CDTM from a list of treatment/disease categories provided in the survey. For each disease/treatment category, the survey also asked respondents to indicate the number of pharmacists in the hospital that are actually involved in administering CDTM for that particular category and also to indicate whether that category has a written protocol for collaborative practice. The disease/treatment categories included were Anticoagulation, Diabetes, Hypertension, Asthma, Emergency contraception, Dyslipidimias, Heart Failure, Infectious disease, General medicine, Smoking cessation, Pain management, Parenteral nutrition and Immunization. The respondents are also provided with spaces marked "Other" where they can add in any disease or treatment that has not been covered by the rest of the categories. This information was used to calculate the proportion of hospitals that authorized CDTM for each disease/treatment area listed, and also the proportion of hospitals that had a written protocol for CDTM in that particular disease/treatment area. This revealed information about the extent CDTM as is being practiced in the hospitals surveyed, in terms of the diseases or treatment areas covered.

In order to assess the scope of CDTM for each disease/treatment category, the survey allowed respondents to indicate the specific kind of CDTM activity that the hospital authorized for each disease category. This was done by providing nine columns for each category that are headed with each type of CDTM activity that the hospital can authorize. The activities listed were (1) initiate drug therapy, (2) change duration of a drug therapy, (3) adjust a drug's strength, (4) change a drug's dosage form, (5) change a drug's frequency of administration, (6) change a drug's route of administration, (7) hold a drug, (8) discontinue a drug and (9) order laboratory or related tests. For each disease/treatment category the respondent marked the boxes below the activities that the hospital authorizes pharmacists to provide for that category. This was used to calculate the proportion of hospitals that authorized any pharmacist to perform each kind of CDTM activity for each disease/treatment category listed. This told us about the scope of CDTM in terms of the specific CDTM activities authorized for each disease/treatment category listed in the survey.

Associations between Hospital Characteristics, Pharmacy Director Characteristics, and CDTM

The survey collected demographic information on pharmacy directors in terms of their gender, age, educational degrees, any residency completed, time since they were first licensed to practice pharmacy and any special certification or recognition they may have received in pharmacy.

Respondents were asked to choose between six levels to indicate their age. Information on respondent gender was also collected. Respondents were asked to indicate the number of degrees they had completed by providing them with five options.

They were asked to indicate the time since obtaining their license by selecting one of the six options provided. Respondents were also asked to indicate the number and types of residencies they had completed, if any. Finally they were asked to indicate whether they had received any special certification or recognition in pharmacy.

Hospital characteristics that were collected included the type of ownership the institution has (Private-non- profit, Private-for- profit, or Government), the institution classification, the population of the city in which the institution is located, the number of days in the hospital and the total number of patient-days in the hospital in the preceding year. Respondents selected the institution classification from the five options provided that were (1) Short-term general and other special (2) Long-term general and other special (3) Psychiatric (Mental health institution) (4) TB and other respiratory diseases and (5) Other (the respondents were asked to specify the classification if it wasn't listed). The population of the city in which the hospital was located was assessed by having respondents select one of the twelve levels provided, while bed size was selected from eight levels of bed sizes provided in the survey. The respondents were also asked to indicate the number of patient-days in their hospital in the previous year on an open ended question.

Pharmacy director characteristics and hospital characteristics were compared for hospitals with and without CDTM. Associations between characteristics and CDTM use were tested using logistic regression. This enabled us to see the kind of association between the different levels of the variable and CDTM use. Logistic regression was used since the outcome variable, CDTM use, was binomial in nature.

Pharmacy Directors' Perceptions Regarding CDTM

The frequency distribution of responses for each of the twenty-seven items assessing pharmacist opinions on CDTM item was generated, to get an estimate of the "spread" of the data. This distribution is included in appendix G. Means and standard deviations were calculated for each of the twenty-seven survey items that dealt with the range and scope of practice in CDTM, support for CDTM by other health care providers and administrators in the hospital , strategic value provided by collaborative practice to the pharmacy, financial value created by collaborative practice and nature of current state regulations that affect collaborative practice. For surveys missing observations for no more than two of the twenty-seven items on perceptions regarding CDTM, the mean score on an item was entered for missing values. For surveys missing observations for more than two items, none of the responses were used in the analysis of perceptions regarding CDTM. Items regarding perceptions on CDTM that were negatively worded were reversed scored for analysis and scale scoring. The responses were based on a 5-point Likert-type scale, where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. These items were further summated to form four scales, namely, the support for CDTM scale (eight items), the strategic impact of CDTM scale (three items), the financial impact of CDTM scale (four items), and the regulation affecting CDTM scale (four items). Ratings on each scale were added and divided by the number of items in the scale, to obtain a score ranging from one to five. Scores close to one indicate strong disagreement and scores close to five indicate strong agreement with the

opinion on CDTM. Items in the CDTM scale were scored such that higher scores represent more positive impact of CDTM.

Associations between Hospital Characteristics, Pharmacy Director Characteristics, and CDTM use

Analysis of Variance was used to determine if there was any difference in perceptions between hospitals with and without CDTM. Mean scores for each of the four scales, namely, the support for CDTM scale (eight items), the strategic impact of CDTM scale (three items), the financial impact of CDTM scale (four items), and the regulation affecting CDTM scale (four items), were compared for hospitals that had CDTM and hospitals that did not have pharmacists engaged in CDTM.

Associations between Hospital Characteristics and Pharmacy Director Perceptions of CDTM

Analysis of variance was used to determine associations between Pharmacy Director Perceptions of CDTM and the demographic characteristics of the hospital. Newman-Keuls multiple means comparison tests were used for Post-hoc analysis in case of significant ANOVA tests. Newman-Keuls tests are most frequently used in psychology and have more power than Tukey tests. ANOVA was used to determine associations between each of the four perceptions scales, namely, the support for CDTM scale (eight items), the strategic impact of CDTM scale (three items), the financial impact of CDTM scale (four items), and the regulation affecting CDTM scale (four items), and hospital characteristics. Associations between pharmacy director characteristics and perceptions of CDTM were tested for the following characteristics gender, age, degrees

obtained, completion of a residency or receipt of any special certification, and number of years since they had initially obtained a license to practice pharmacy.

Associations between Pharmacy Director Characteristics and Pharmacy Director Perceptions of CDTM

Analysis of variance was used to determine associations between Pharmacy Director Perceptions of CDTM and the demographic characteristics of the hospital. Newman-Keuls multiple means comparison tests were used for Post-hoc analysis in case of significant ANOVA tests. Newman-Keuls tests are most frequently used in psychology and have more power than Tukey tests. ANOVA was used to determine associations between hospital characteristics and ratings on each of the four perceptions scales, namely, the support for CDTM scale (eight items), the strategic impact of CDTM scale (three items), the financial impact of CDTM scale (four items), and the regulation affecting CDTM scale (four items). The hospital characteristics that were tested for associations with pharmacy director perceptions of CDTM were institution ownership, institution classification, population of the city in which the institution was located, number of beds

Plans Regarding CDTM

The survey asked all respondents to indicate their short- and long-term plans for CDTM on a 5-point Likert-type scale, where 1 = large decrease, 2 = slight decrease, 3 = no change, 4 = slight increase, and 5 = large increase. Three items assess the hospitals' long term plans for CDTM and three items assess the short term plans for CDTM. The survey asked respondents to indicate whether the hospitals has any short term plans

within one year to make any changes in the following three categories (1) Number of staff pharmacists involved in CP, (2) Number of CP protocols and (3) Number of diseases/ therapies in which pharmacist provide CP. The same questions are repeated for long term plans that extend beyond one year. Each item was rated on the 5 point Likert scale previously described, that ranged from large decrease to large increase. The data on the short-term (within one year) and long-term plans (beyond one year) of hospitals for changes in various aspects of CDTM was tabulated. Means and standard deviations were calculated for each of the items and the percentage of respondents indicating each response was also calculated, both for short term as well as long term plans.

Facilitators and Barriers for CDTM In Hospitals.

All respondents were asked in open-ended questions to indicate what they perceived to be the greatest barrier to CDTM and the greatest facilitator of CDTM. These responses were grouped into common themes and tabulated to show the frequency with which a particular barrier or facilitator was mentioned by the respondents. The barriers and facilitators so identified were then ordered by frequency in a table that displayed the most commonly identified barriers and facilitators according to their prevalence in the survey answers. Some respondents provided multiple answers to both questions and each answer was counted as a separate response while computing frequencies.

Tests for Response Bias

To test for potential non-response bias, the first third of respondents were compared with the last third of respondents. Based on 'the continuum of resistance model' late respondents can be used as a proxy for non-respondents in estimating non-response bias, while early respondents are indicative of all respondents, hence the difference between the two will reflect the non-response bias (Voogt et al. 1998). Chi-square tests were used to compare categorical variables for early respondents and late respondents and analysis of variance were used to compare continuous variables for early and late respondents. The characteristics of early and late respondents that were compared were the proportion of hospitals that engaged in CDTM, perceptions regarding CDTM, hospital characteristics, and pharmacy directors' characteristics.

In addition to comparing early and late respondents, the sample distribution on the basis of the number of beds in the hospitals (Bed Size) was compared to the distribution of bed sizes of the population. The purpose of doing this was to determine whether the random sample that had been drawn differed significantly from the rest of the population in terms of demographic characteristics. Bed Size was used as the parameter since bed size data was available for respondents as well as non respondents.

Human Subjects

The survey along with the cover letters that were to be sent with the surveys to each respondent were submitted along with other required documents to the Institutional Review Board at Purdue University to seek prior approval for the. The study proposal was approved prior to the commencement of data collection.

Notes

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RESULTS

Demographic Characteristics

Demographic characteristics of the study sample, including both hospital and pharmacy director characteristics, are summarized using frequency distributions and means and standard deviations where appropriate. Frequency distributions for institution ownership, institution classification, population of the city in which the institution was located, number of beds, and total number of patient days in the hospital in the past year as well as pharmacy directors‘ sex, age, degrees obtained, completion of a residency or receipt of any special certification, and number of years since they had initially obtained a license to practice pharmacy were developed to gain understanding of the demographic characteristics of the population.

Hospital Characteristics

Distribution of Hospitals by Institution Ownership

The distribution of the respondent hospitals by their institution ownership is shown in Table 2. Of the 283 hospitals surveyed, 198 (72.5 percent) were private, not-for-profit hospitals, twenty (7.3 percent) were private, for-profit hospitals, while sixteen (5.86 percent) were government owned. Thirty-nine hospitals (14.2 percent) did not fall under any of the aforementioned categories.

Table 2. Distribution of Hospitals by Ownership

Ownership	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Missing/Unknown	10	3.53	10	3.53
Private	198	72.53	198	72.53
Private (For Profit)	20	7.33	218	79.85
Government(City, county, state)	16	5.86	234	85.71
Other	39	14.20	283	100.00

Distribution of Hospitals by Institution Classification

The distribution of the respondent hospitals by their institution classification is shown in Table 3. Of the 283 hospitals surveyed, 198 (69.96 percent) were of type Short-Term General, twenty (7.07 percent) were Long Term General, while sixteen (5.65 percent) were Psychiatric facilities. Only one hospital specialized in TB and other respiratory diseases.

Distribution of Hospitals by City Population

Table 4 shows the frequency distribution of the respondent hospitals based on the population of the city they are located in. Two hundred and sixty-eight respondents volunteered information on their city population. Of all respondent hospitals, only eleven (3.89 percent) hospitals had less than thousand people in their city, with a total of twenty-nine (10.8 percent) hospitals located in cities with less than 2,500 people. Respondent hospitals' cities were fairly evenly distributed over the 5,000 to 250,000 people range, with the 5,000 to 25,000 bracket having the maximum frequency of respondents (83 hospitals, 29.33 percent). The maximum concentration of hospitals was in cities with 5,000 to 250,000 people (183 hospitals, 64.66 percent). Forty-one hospitals were located in cities with more than 500,000 people.

Table 3. Distribution of Hospitals by Institution Classification

Institution Class	Frequency N=283	Percent	Cumulative Frequency	Cumulative Percent
Missing/Unknown	10	3.53	10	3.53
Short-term General and other special	198	69.96	208	73.50
Long-term General and other special	20	7.07	228	80.57
Psychiatric	16	5.65	244	86.22
TB and other respiratory diseases	1	0.37	245	86.59
Other	38	13.41	283	100.00

Table 4. Distribution of Hospitals by City Population

City Population	Frequency N=283	Percent	Cumulative Frequency	Cumulative Percent
Missing/Unknown	15	5.30	15	5.30
Less than 1,500	11	3.89	26	9.19
1,500 to 4,999	18	6.36	44	15.55
5,000 to 24,999	83	29.33	127	44.88
25,000 to 99,999	65	22.97	192	67.84
100,000 to 499,999	50	17.67	242	85.51
More than 500,000	41	14.49	283	100.00

Pharmacy Director Characteristics

Distribution of Pharmacy Directors by Age

The survey sample distribution by respondent age is shown in Table 5. Out of 283 participants, 102 (36.04 percent) were between 55 to 64 years old, sixty-six (23.32 percent) were between 45 and 54 years and sixty-one (21.55 percent) were between 35 and 44 years. Only two people were less than twenty-five years old.

Distribution of Pharmacy Directors by Gender

The survey sample distribution by respondent gender is shown in Table 6. Out of 283 participants, 158 (55.83 percent) were female, while male respondents comprised the remaining 38.52 percent of the sample that provided their gender.

Distribution of Pharmacy Directors by License time

Table 7 shows the sample distribution by years since obtaining a license. The majority of the participants, that is 192 respondents or 67.84 percent of all respondents, had received their license to practice Pharmacy more than fifteen years prior to the study. Out of 283 respondents, 248 (87.63 percent) had had a license for more than five years. Only three pharmacy directors had received their license within the last three years.

Distribution of Pharmacy Directors by Completion of Residency

The survey sample distribution of pharmacy directors by completion of a pharmacy related residency is shown in Table 8. Most pharmacy directors had not completed a residency. Only forty-seven of 279 (16.61 percent) respondents had a residency. Of these, thirty-three pharmacy directors had completed a General Residency

(11.66 percent of all respondents), as shown in Table 9. Only thirteen pharmacy directors (4.05 percent) had completed a specific residency as seen in Table 10.

Distribution of Pharmacy Directors by Education

Tables 11 to 15 show the survey sample distribution of the degrees obtained by the pharmacy directors . As shown in Table 11, approximately half of the respondents had a Doctor of Pharmacy degree. One hundred and fifty two (53.71 percent) of respondents had a Bachelor of Science in Pharmacy degree (Table 12), while nineteen (6.71 percent) of the respondents had an M.S. degree (Table 13). Only three (1.06 percent) pharmacy directors had a Ph.D. degree, as seen in Table 13.

Extent of CDTM

Percentage of Hospitals with CDTM

The percentage of hospitals with CDTM was calculated based on the responses to the survey question "Do pharmacists in your hospital engage in collaborative practice that involves initiation or modification of drug therapy, i.e., active intervention beyond a written consult or general therapeutic interchange protocols?" Of the 283 responses received, 186 respondents indicated "Yes" to the question, which means that sixty-five percent of the respondent hospitals had at least some pharmacists engaged in Collaborative Drug Therapy Management or CDTM

Percentage of Pharmacists engaged in CDTM

The survey asked respondents to list the number of pharmacists employed at the hospitals as well as the number of pharmacists actually involved in CDTM. A total of 2308 pharmacists were employed across all the respondent hospitals surveyed. Of these, 1548 pharmacists were actively engaged in providing CDTM services to patients. Therefore, sixty-six percent of all pharmacists employed by the respondent hospitals were participating in CDTM.

Percentage of Hospitals with Written Protocols

Respondents were asked to indicate if their hospital had specific written protocols for collaborative drug therapy management. Of the 277 participants who responded to this question, 163 (58.8 percent) indicated having written protocols in place at their hospital.

Distribution of Hospitals by Type of Protocol

Table 16 shows the survey sample distribution of the respondent hospitals by the type of written protocol defined for collaborative practice . One hundred and two (36.04 percent) hospitals had protocols that were disease or treatment specific, while eighty-one (28.62 percent) of the hospitals had protocols that were general for several diseases or treatments. Three (1.8 percent) of hospitals indicated having protocols that did not fall into either of the aforementioned categories. Hospitals could have protocols of more than one type, hence the categories are not mutually exclusive.

Table 5. Distribution of Pharmacy Directors by Age

Age	Frequency N=283	Percent	Cumulative Frequency	Cumulative Percent
Missing/Unknown	19	6.71	19	6.71
Less than 34 years	23	8.13	42	14.84
35 to 44 years	61	21.55	103	36.40
45 to 54 years	66	23.32	169	59.72
55 to 64 years	102	36.04	271	95.76
More than 65 years	12	4.55	264	100.00

Table 6. Distribution of Pharmacy Directors by Gender

Age	Frequency N=283	Percent	Cumulative Frequency	Cumulative Percent
Missing/No response	16	5.65	16	5.65
Male	109	38.52	125	44.17
Female	158	55.83	283	100.00

Table 7. Distribution of Pharmacy Directors by License Time

License Time	Frequency N=283	Percent	Cumulative Frequency	Cumulative Percent
Missing/Unknown	18	6.36	18	6.36
1 to 3 years	3	1.06	21	7.42
3 to 5 years	10	3.53	31	10.95
5 to 10 years	22	7.77	53	18.73
10 to 15 years	38	13.43	91	32.16
More than 15 years	192	67.84	283	100.00

Table 8. Distribution of Pharmacy Directors by Completion of Residency

Residency	Frequency N=283	Percent	Cumulative Frequency	Cumulative Percent
Missing/Unknown	4	1.41	4	1.41
No Residency	232	81.98	236	83.39
Residency completed	47	16.61	283	100.00

Table 9. Distribution of Pharmacy Directors by Completion of General Residency

Residency	Frequency N=283	Percent	Cumulative Frequency	Cumulative Percent
No General Residency	186	65.72	186	65.72
General Residency completed	33	11.66	219	100.00
Missing/Unknown	64	22.61	283	100.00

Table 10. Distribution of Pharmacy Directors by Completion of Specific Residency

Residency	Frequency N=283	Percent	Cumulative Frequency	Cumulative Percent
No Specific Residency	201	71.02	201	71.02
Specific Residency completed	13	4.05	214	75.07
Missing/Unknown	69	24.38	283	100.00

Table 11. Distribution of Pharmacy directors with a Doctor of Pharmacy degree

Degree	Frequency N=283	Percent	Cumulative Frequency	Cumulative Percent
Missing/Unknown	12	4.24	12	4.24
No Degree	135	47.70	147	51.94
Have Degree	136	48.06	283	100.00

Table 12. Distribution of Pharmacy Directors with a BS in Pharmacy Degree

Degree	Frequency N=283	Percent	Cumulative Frequency	Cumulative Percent
Missing/Unknown	15	5.30	15	5.30
No Degree	116	40.99	131	46.29
Have Degree	152	53.71	283	100.00

Table 13. Distribution of Pharmacy Directors with an M.S. Degree

Degree	Frequency N=283	Percent	Cumulative Frequency	Cumulative Percent
Missing/Unknown	32	11.31	32	11.31
No Degree	232	81.98	264	93.29
Have Degree	19	6.71	283	100.00

Table 14. Distribution of Pharmacy Directors with a Ph.D. degree

Degree	Frequency N=283	Percent	Cumulative Frequency	Cumulative Percent
Missing/Unknown	32	11.31	32	11.31
No Degree	248	87.63	280	98.94
Have Degree	3	1.06	283	100.00

Table 15. Distribution of Pharmacy Directors with any Other Degree

Degree	Frequency N=283	Percent	Cumulative Frequency	Cumulative Percent
Missing/Unknown	27	9.54	27	9.54
No Degree	216	76.33	243	85.87
Have Degree	40	14.13	283	100.00

Table 16. Distribution of Hospitals by Type of Written CDTM Protocol

Hospitals with Protocol of Type	Frequency N=283	Percent
Treatment/Disease specific	102	36.04
General	81	28.62
Any	163	57.59

CDTM Activities

Pharmacists engaged in Collaborative Drug Therapy Management can perform a range of activities. These include initiating drug therapy, adjusting a drug's strength, ordering laboratory or related tests, changing a drug's frequency of administration and discontinuing a drug. Hospitals may allow pharmacists to perform the specific CDTM activities or services for any patient or they can impose restrictions on the scope of the activity by only allowing the CDTM activity to be carried out for a specific patient, disease or treatment type. The survey asked respondents to indicate which CDTM activities their hospitals permitted pharmacists to perform. They were further asked to indicate if each CDTM activity was permitted for all patients or only for a specific sub-category of patients. The responses to the survey items on CDTM activities are summarized in this section.

Proportion of Hospitals that Authorize Pharmacists to Initiate Drug Therapy

Table 17 shows the proportion of hospitals that allow pharmacists to "initiate drug therapy" for patients as part of CDTM. Of the 183 hospitals surveyed that responded yes to having some form of CDTM, 46.98 percent of the respondents indicated that pharmacists in their facility were authorized to initiate drug therapy for any patients. 36.29 percent of respondent hospitals only allowed pharmacists to initiate drug therapy for certain diseases and drug therapies, while 12.27 percent of the respondent hospitals allowed pharmacists to initiate drug therapy for all patients, regardless of disease or treatment category.

Table 17. Proportion of Hospitals that Authorize Pharmacists to Initiate Drug Therapy

	Percentage of Hospitals with CDTM Authorizing Activity		
CDTM Activity	For all patients	For certain diseases and therapies only	For any patients
Initiate Drug therapy	12.27	36.29	46.98

Proportion of Hospitals that Authorize Pharmacists to Change Duration of Drug Therapy

The distribution of hospitals that allow pharmacists to "change duration of drug therapy" for patients under CDTM is shown in Table 18. Of the 183 hospitals that had CDTM, 42.99 percent of the respondents indicated that pharmacists in their facility were authorized to change duration of drug therapy for any patients. 21.58 percent of respondent hospitals allowed pharmacists to change duration of drug therapy for certain diseases and drug therapies only, while 15.07 percent of the respondent hospitals allowed pharmacists to change duration of drug therapy for all patients, regardless of disease or treatment category.

Proportion of Hospitals that Authorize Pharmacists to Adjust a Drug's Strength

Table 19 shows the proportion of hospitals that allow pharmacists to "adjust a drug's strength" for patients as part of CDTM. 81.59 percent of the 183 respondent hospitals with CDTM indicated that pharmacists in their facility were authorized to adjust a drug's strength for any patients, which makes "adjusting a drug's strength" the second most common CDTM activity being performed by pharmacists at the respondent hospitals. 51.35 percent of respondent hospitals allowed pharmacists to initiate drug therapy only for certain diseases and drug therapies only, while 34.60 percent of the respondent hospitals allowed pharmacists to initiate drug therapy for all patients, regardless of disease or treatment category.

Table 18. Proportion of Hospitals that Authorize Pharmacists to Change Duration of Drug Therapy

CDTM Activity	Percentage of Hospitals with CDTM Authorizing Activity		
	For all patients	For certain diseases and therapies only	For any patients
Change duration of drug therapy	15.07	21.58	42.99

Table 19. Proportion of Hospitals that Authorize Pharmacists to Adjust a Drug's strength

CDTM Activity	Percentage of Hospitals with CDTM Authorizing Activity		
	For all patients	For certain diseases and therapies only	For any patients
Adjust a Drug's strength	34.60	51.35	89.59

Proportion of Hospitals that Authorize Pharmacists to Change a Drug's Dosage Form

Table 20 shows the proportion of hospitals that allow pharmacists to "change a drug's dosage form" for patients as part of CDTM. Of the 183 hospitals that had CDTM, 80.67 percent of the respondents indicated that pharmacists in their facility were authorized to initiate drug therapy for any patients. 28.47 percent of respondent hospitals only allowed pharmacists to initiate drug therapy for certain diseases and drug therapies, while 42.43 percent of the respondent hospitals allowed pharmacists to initiate drug therapy for all patients, regardless of disease or treatment category. This CDTM activity is unusual since it is one of only two activities for which a larger percentage of hospitals allowed pharmacists to change a drug's dosage form for all patients than allowed pharmacists to change drug dosage forms only for specific patients.

Proportion of Hospitals that Authorize Pharmacists to Change a Drug's Frequency of Administration

Table 21 shows the proportion of hospitals that allow pharmacists to "change a drug's frequency of administration" for patients as part of CDTM. Of the 183 hospitals that had CDTM, 83.1 percent of the respondents indicated that pharmacists in their facility were authorized change a drug's frequency of administration for any patients. 50.80 percent of respondent hospitals only allowed pharmacists to change a drug's frequency of administration for certain diseases and drug therapies, while 30.71 percent of the respondent hospitals allowed pharmacists to change a drug's frequency of administration for all patients, regardless of disease or treatment category.

Table 20. Proportion of Hospitals that Authorize Pharmacists to Change a Drug's Dosage form

CDTM Activity	Percentage of Hospitals Authorizing Activity		
	For all patients	For certain diseases and therapies only	For any patients
Change a Drug's Dosage form	42.43	28.47	80.67

Table 21. Proportion of Hospitals that Authorize Pharmacists to Change a Drug's Frequency of Administration

CDTM Activity	Percentage of Hospitals Authorizing Activity		
	For all patients	For certain diseases and therapies only	For any patients
Change a Drug's frequency of administration	30.71	50.80	83.10

Proportion of Hospitals that Authorize Pharmacists to Change a Drug's Route of Administration

Table 22 shows the proportion of hospitals that allow pharmacists to "change a drug's route of administration" for patients as part of CDTM. 53.40 percent of the 183 hospitals that had CDTM indicated that pharmacists in their facility were authorized to change a drug's route of administration for any patient. 26.79 percent of respondent hospitals only allowed pharmacists to change a drug's route of administration for certain diseases and drug therapies, while 28.47 percent of the respondent hospitals allowed pharmacists to change a drug's route of administration for all patients, regardless of disease or treatment category. This is the second activity for which a larger percentage of hospitals allowed pharmacists to change a drug's dosage form for all patients than allowed pharmacists to change drug dosage forms only for specific patients, however the difference in percentages is low as compared to "changing drug dosage form".

Proportion of Hospitals that Authorize Pharmacists to Hold a Drug

Table 23 shows the proportion of hospitals that allow pharmacists to "hold a drug" for patients as part of CDTM. Of the 183 hospitals that responded yes to having any pharmacists involved in CDTM, 68.08 percent of the respondents indicated that pharmacists in their facility were authorized to hold a drug for any patient, 20.66 percent of respondent hospitals allowed pharmacists to hold a drug for certain diseases and therapies only, while 11.01 percent of the respondent hospitals allowed pharmacists to hold a drug for all patients, regardless of disease or treatment category.

Table 22. Proportion of Hospitals that Authorize Pharmacists to Change a Drug's Route of Administration

CDTM Activity	Percentage of Hospitals Authorizing Activity		
	For all patients	For certain diseases and therapies only	For any patients
Change a drug's route of administration	28.47	26.79	53.40

Table 23. Proportion of Hospitals that Authorize Pharmacists to Hold a Drug

CDTM Activity	Percentage of Hospitals Authorizing Activity		
	For all patients	For certain diseases and therapies only	For any patients
Hold a drug	20.66	11.01	68.08

Proportion of Hospitals that Authorize Pharmacists to Discontinue a Drug

Table 24 shows the proportion of hospitals that allow pharmacists to "discontinue a drug" for patients as part of CDTM. Of 183 hospitals with CDTM, 50.24 percent of the respondents indicated that pharmacists in their facility were authorized to discontinue a drug for any patient, 32.2 percent of respondent hospitals allowed pharmacists to discontinue a drug for certain diseases and therapies only, while 17.30 percent of the respondent hospitals allowed pharmacists to discontinue a drug for all patients, regardless of disease or treatment category. The distribution was almost identical to that of hospitals that allowed pharmacists to "hold a drug".

Proportion of Hospitals that Authorize Pharmacists to Order Laboratory or Related Tests

Table 25 shows the proportion of hospitals that allow pharmacists to "order laboratory or related tests" for patients as part of CDTM. 90.77 percent of 183 respondent hospitals with CDTM indicated that pharmacists in their facility were authorized to order laboratory or related tests for any patients, which makes "ordering laboratory or related tests" the most common CDTM activity being performed by pharmacists at all respondent hospitals. 57.49 percent of respondent hospitals allowed pharmacists to initiate drug therapy only for certain diseases and drug therapies, while 31.26 percent of the respondent hospitals allowed pharmacists to initiate drug therapy for all patients, regardless of disease or treatment category.

Table 24. Proportion of Hospitals that Authorize Pharmacists to Discontinue a drug

CDTM Activity	Percentage of Hospitals Authorizing Activity		
	For all patients	For certain diseases and therapies only	For any patients
Discontinue a drug	17.30	32.2	50.24

Table 25. Proportion of Hospitals that Authorize Pharmacists to Order Laboratory or Related Tests

CDTM Activity	Percentage of Hospitals Authorizing Activity		
	For all patients	For certain diseases and therapies only	For any patients
Order Laboratory or related tests	31.26	57.49	90.77

CDTM Activities by Disease or Treatment Areas

Table 26 lists the diseases or treatment areas for which pharmacists were involved in CDTM. Pharmacists were most frequently involved in CDTM for infectious diseases or antibiotics, anticoagulants, and parenteral nutrition. The binomial proportions and 95 percent confidence intervals for the three most common disease or treatment areas are as follows: 52.4 percent of all hospitals with a 95 percent confidence interval of (46.7-58.1) provided CDTM for Anticoagulation, 44.8 percent of all hospitals with a 95 percent confidence interval of (39.0-50.6) provided CDTM. for Infectious Diseases and 32.6 percent of all hospitals with a confidence interval of (27.2-38.0) provided CDTM for Parenteral Nutrition. The disease/treatment categories included in the survey were Anticoagulation, Diabetes, Hypertension, Asthma, Emergency contraception, Dyslipidimias, Heart Failure, Infectious disease, General medicine, Smoking cessation, Pain management, Parenteral nutrition and Immunization. For each of these categories, pharmacy directors were asked to indicate which specific CDTM activities were being carried out by pharmacists in their hospitals for patients of that particular category. This information is summarized in Table 27. For the treatment category "anticoagulation", across all hospitals hospitals that allowed CDTM, eighty-one percent allowed CDTM for anticoagulation patients. The most common CDTM activities for patients getting anticoagulation therapy in hospitals with CDTM were ordering of laboratory tests (allowed by sixty-nine percent of all hospitals with CDTM), adjusting a drug's strength (allowed by sixty-one percent of all CDTM hospitals) and holding a drug (sixty percent of CDTM hospitals). Two of these three activities are also the most common CDTM activities across all treatment/disease categories; however "holding a drug" is more

common in anticoagulation patients as compared to patients in general. Therefore the trend within anticoagulation does not mirror the trend across all diseases. In the case of infectious diseases, while the top three most common activities remains the same as for all diseases, the order is reversed. The most commonly allowed CDTM activity for infectious disease patients was found to be adjusting a drug's strength, which was allowed by sixty-seven percent of all CDTM hospitals, followed by changing a drug's route of administration (sixty-two percent of CDTM hospitals) and then ordering of laboratory tests (fifty-six percent of CDTM hospitals). Therefore it can be seen that the extent of CDTM activities by pharmacists varied by disease or treatment area. While more hospitals allowed pharmacists to adjust a drug's strength for patients taking anticoagulants or antibiotics, fewer hospitals allowed pharmacists to adjust a drug's strength for patients with hypertension. Pharmacists were seen to have almost zero involvement in any kind of CDTM activity for Emergency Contraception. Asthma was the disease/treatment category with the second lowest percentage of pharmacist involvement, with pharmacists in only four percent of all hospitals that had some form of CDTM being involved in CDTM for Asthma patients.

Reimbursement for CDTM activities

Percentage of Hospitals Charging a Fee for CDTM Services

Table 27 shows the sample distribution of responses of hospitals based on whether or not the hospital charged any sort of fee for the CDTM services being provided to patients. Of the 183 hospitals that had responded "Yes" to having CDTM, only twenty-five pharmacy directors indicated that patients were charged a fee for CDTM

Table 26. Proportion of CDTM Activities Allowed by Disease/Treatment Category in Hospitals with CDTM

Disease or Treatment Area	Percentage of Hospitals with CDTM									
	Any Activity	Initiate drug therapy	Change duration of a drug therapy	Adjust a drug's strength	Change a drug's dosage form	Change a drug's frequency of administration	Change a drug's route of administration	Hold a drug	Discontinue a drug	Order laboratory or related tests
Anticoagulation	80.4	34.1	33.5	61.1	25.4	53.0	19.5	60.0	33.0	69.2
Diabetes	20.13	8.1	5.4	10.8	7.6	11.4	5.9	12.4	10.3	11.4
Hypertension	5.9	4.9	3.8	5.4	6.5	8.1	3.8	8.1	4.9	4.9
Asthma	2.2	2.2	3.2	2.7	3.2	3.8	2.7	2.7	2.7	1.6
Emergency Contraception	0.5	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Dyslipidemias	11.7	5.9	5.4	7.0	4.9	6.5	4.3	6.5	3.8	5.9
Heart Failure	9.5	5.4	5.9	5.9	5.4	7.6	4.9	5.9	3.2	7.6
Infectious Diseases	69.3	24.9	34.6	65.9	38.9	62.7	30.8	48.1	29.2	56. 2
General Medicine	26.3	8.6	10.3	17.8	16.2	17.3	14.6	14.1	12.4	14.6
Smoking Cessation	12.3	6.5	3.8	8.6	5.4	7.0	5.4	7.0	4.9	4.9
Pain Management	21.1	9.7	9.2	14.6	9.2	11.4	8.1	10.8	8.6	9. 2
Parenteral Nutrition	50.4	21.6	20.5	38.4	20.0	24.9	14.6	25.9	19.5	40. 5
Immunization	19.1	11.4	3.8	5.4	3.8	3.8	3.8	3.8	2.7	3. 2

services, which means that only 13.7 percent of the respondent hospitals received reimbursement for CDTM activities performed by a pharmacist. These percentages are in terms of the number of hospitals that had some kind of CDTM service provided. In terms of total number of respondents in the sample, 9.7 percent of the hospitals charged a fee for CDTM.

Distribution of CDTM Activities for Which Hospitals Charge a Fee

Table 28 shows the sample distribution of the CDTM activities for which hospitals charge a fee. Out of 283 respondents, twenty-five pharmacy directors indicated "Yes" to the question "Does your hospital charge a fee for CDTM services?" Of these twenty-five pharmacy directors that indicated that their hospitals charged a fee for CDTM services, twenty-three respondents volunteered further information on the type of patients that were charged a fee. Nineteen (82.6 percent) of these hospitals only charged outpatients for CDTM services, while three (thirteen percent) charged only inpatients for CDTM. Only one hospital charged both inpatients as well as outpatients for CDTM activities performed by a pharmacist.

Associations between Hospital Characteristics and CDTM Use

Comparison of Hospitals with and without Collaborative Drug Therapy Management (CDTM) by Institution Ownership

Associations between Institution Ownership and CDTM use were tested using logistic regression. The results are summarized in Tables 29 and 31. The p-value for the test was less than the a priori alpha 0.05, indicating that there was a significant association between Institution Ownership and CDTM use. This implied that the

Table 27. Proportion of Hospitals Charging a Fee for CDTM services

Residency	Frequency	Percent	Cumulative Frequency (N=183)	Cumulative Percent
No Fee charged	158	86.33	158	86.63
Fee Charged	25	13.66	183	100.00

Table 28. Distribution of Hospitals Charging a Fee for CDTM by whether Charged for Inpatients, Outpatients or Both

Residency	Frequency	Percent	Cumulative Frequency (N=23)	Cumulative Percent
Inpatient Only	3	13.04	3	13.04
Outpatient Only	19	82.60	22	95.64
Both Inpatient and Outpatient	1	4.34	23	100.00

likelihood of the hospital having CDTM differed based on whether the institution was Private (Non Profit), Government or Private (for Profit). Logistic regression was carried out using "Private (Non Profit)" as the reference category and it was found that Government hospitals were 0.25 times as likely as Private (non profit) hospitals to have CDTM, while Private (for profit) hospitals were 0.6 times as likely as Private (Non Profit) hospitals to have CDTM, though the difference was not significant in this case. Combining the two categories that were not found to be statistically different into a single "Private" category, logistic regression was carried out again using "Government hospitals" as the reference category. It was found that Private hospitals were 3.3 times more likely to have CDTM than government hospitals ($p<0.001$).

Comparison of Hospitals with and without Collaborative Drug Therapy Management (CDTM) by Institution Classification

Associations between Institution Classification and CDTM use were tested using chi square tests and logistic regression. The results are summarized in Tables 29 and 31. The p-value for the test was greater than the a priori alpha 0.05, indicating that there were no significant associations between Institution Classification and CDTM use.

Associations between Institution Classification and CDTM use were tested using chi square tests and logistic regression. The results are summarized in Tables 29 and 31. The p-value for the test was greater than the a priori alpha 0.05, indicating that there were no significant associations between Institution Classification and CDTM use.

Comparison of Hospitals with and without Collaborative Drug Therapy Management (CDTM) by City Population

Associations between population of the city the hospital is located in and CDTM use were tested using logistic regression. The results are summarized in Tables 29. The p-value for the test was less than the a priori alpha 0.05, indicating that there was a significant association between city population and CDTM use. This implied that the likelihood of the hospital having CDTM differed based on the population bracket that the city that the hospital was located in fell under. Logistic regression was carried out using cities with ">500,000 people" as the reference category. It was found that hospitals located in cities with between 25,000 and 500,000 people were 1.3 times as likely to have CDTM as cities with populations greater than 500,000 ($p<0.05$). On the other hand hospitals in cities with less than 5000 people were only 0.15 times as likely to have CDTM as hospitals in cities with more than 500,000 people ($p<0.001$). The other categories were not found to differ significantly from the reference category.

Comparison of Hospitals with and without Collaborative Drug Therapy Management (CDTM) by Bed Size

Associations between bed size and CDTM use were tested using logistic regression. The results are summarized in Tables 29. The p-value for the test was less than the a priori alpha 0.05, indicating that there was a significant association between bed size and CDTM use. Logistic regression was carried out using "100 to 199 beds" as the reference category for hospital bed size and it was found that only hospitals with between 6 and 49 beds differed significantly with respect to reference group regarding likelihood of having CDTM. Combining categories that were not found to be statistically

different into a single "bed size >50" category, logistic regression was carried out again using bed size "between 6-49 beds" as the reference category. It was found that hospitals with more than fifty beds were 2.5 times more likely to have CDTM as compared to hospitals with six to forty-nine beds (p=0.005)

Associations between Pharmacy Director Characteristics and CDTM Use

Comparison of Hospitals with and without Collaborative Drug Therapy Management (CDTM) by Respondent Age

Associations between Pharmacy director age and CDTM use were tested using logistic regression. The results are summarized in Table 29. The p-value for the test was greater than the a priori alpha 0.05, indicating that there were no significant associations between Pharmacy director Age and CDTM use.

Comparison of Hospitals with and without Collaborative Drug Therapy Management (CDTM) by Respondent Gender

Associations between Pharmacy director gender and CDTM use were tested using logistic regression. The results are summarized in Table 29. The p-value for the test was greater than the a priori alpha 0.05, indicating that there were no significant associations between Pharmacy director Gender and CDTM use.

Comparison of Hospitals with and without Collaborative Drug Therapy Management (CDTM) by Respondent Age

Associations between Pharmacy director age and CDTM use were tested using logistic regression. The results are summarized in Table 29. The p-value for the test was

greater than the a priori alpha 0.05, indicating that there were no significant associations between Pharmacy director Age and CDTM use.

Comparison of Hospitals with and without Collaborative Drug Therapy Management (CDTM) by Pharm.D. degree received by Pharmacy director

Logistic regression was used to determine whether the likelihood of a hospital having CDTM was affected by the pharmacy director having or not having a Pharm.D. degree. The results are summarized in Table 29. The p-value for the test was 0.02, less than the a priori alpha 0.05. This indicates that there was a significant associations between Pharmacy director having a Pharm.D. degree and CDTM use. Logistic regression was carried out using hospitals whose pharmacy directors did not have a Pharm.D. degree ("No degree") as the reference category. It was found that hospitals with pharmacy directors that had a Pharm. D. degree were 1.8 times as likely to have CDTM as hospitals whose pharmacy directors had some other degree ($p<0.05$).

Comparison of Hospitals with and without Collaborative Drug Therapy Management (CDTM) by Pharmacy Director Licensure Time

Associations between Pharmacy director licensure time and CDTM use were tested using logistic regression. The results are summarized in Table 29. The p-value for the test was greater than the a priori alpha 0.05, indicating that there were no significant associations between Pharmacy director licensure time and CDTM use.

Comparison of Hospitals with and without Collaborative Drug Therapy Management (CDTM) by Pharmacy Director Residency Completed

Associations between Pharmacy director having completed a residency and CDTM use were tested using logistic regression. The results are summarized in Table

29. The p-value for the test was greater than the a priori alpha 0.05, indicating that there were no significant associations between Pharmacy director residency completed and CDTM use in the hospital.

Comparison of Hospitals with and without Collaborative Drug Therapy Management (CDTM) by Pharmacy Director Special Certification

Associations between Pharmacy director having received a special certification and CDTM use were tested using logistic regression. The results are summarized in Table 30. The p-value for the test was greater than the a priori alpha 0.05, indicating that there were no significant associations between Pharmacy director receiving a special certification and CDTM use in the hospital.

Perceptions of CDTM

Pharmacy Director perceptions of Collaborative Drug Therapy Management (CDTM) were assessed by asking respondents to rate their agreement with 27 items regarding views on CDTM on a 5 point Likert scale, where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. The "Perceptions Scale" consisted of 27 items assessing respondents' opinions about the (1) range and scope of practice in CDTM (6 items), (2) support for CDTM by other health care providers and administrators in the hospital (9 items), (3) strategic value provided by collaborative practice to the pharmacy (3 items), (4) financial value created by collaborative practice (5 items), and (5) nature of current state regulations that affect collaborative practice (4 items).

Table 29. Associations between Demographic Characteristics and CDTM

Variable	Odds Ratio	95% C.I.	p value
Bed size			0.006
100 to 199	Reference Category		
200 to 599	0.77	0.34 - 1.77	0.545
50 to 99	0.86	0.86 - 0.35	0.735
6 to 49	0.34	0.16 - 0.73	0.006
Bed size (condensed)[1]			0.005
6 to 49	Reference Category		
More than 50	2.51	1.51 - 4.23	0.005
City Population			<0.001
More than 500,000	Reference Category		
100,000 to 499,999	1.30	0.49 - 3.40	0.026
25,000 to 99,999	1.36	0.55 - 3.38	0.009
5,000 to 24,999	0.49	0.22 - 1.10	0.181
Less than 4,999	0.15	0.05 - 0.43	<0.001
Institution Ownership			<0.001
Private(Non Profit)	Reference Category		
Government	0.25	0.13 - 0.47	<0.001
Private(for Profit)	0.57	0.30 - 1.05	0.654
Institution Ownership[2]			<0.001
Government	Reference Category		
Private	3.3	1.83 - 5.89	<0.001
Doctor of Pharmacy Degree			0.020
No degree	Reference Category		
Degree	1.83	1.09 - 3.05	0.021

[1,2]Groups that did not differ significantly were combined

Table 30. Associations between Demographic Characteristics and CDTM

Variable	Odds Ratio[1]	95% C.I.	p value
Institution Classification			0.215
Short Term General	Reference Category		
Long Term General	0.48	0.19 - 1.21	0.284
Psychiatric	0.48	0.17 - 1.33	0.478
Other	1.12	0.53 - 2.33	0.324
Gender			0.3814
Female	Reference Category		
Male	1.26	0.76 - 2.10	0.363
Age			0.246
35 to 45 years	Reference Category		
45 to 54 years	1.52	0.73 - 3.15	0.261
55 to 64 years	1.17	0.62 - 2.38	0.627
Less than 34 years	3.21	0.97 - 10.56	0.055
More than 65 years	0.67	0.19 - 2.33	<0.535
Residency			<0.137
No residency	Reference Category		
Has residency	1.71	0.84 - 3.47	<0.137
Certification			0.051
No certification	Reference Category		
Certification	1.88	0.99 - 3.53	0.051

[1]Logistic regression run on each variable for the binary outcome variable "Engaged in CDTM"

[2,3]Groups that did not differ significantly were combined

These items were further summated to form four scales, namely, the support for CDTM scale (eight items), the strategic impact of CDTM scale (three items), the financial impact of CDTM scale (four items), and the regulation affecting CDTM scale (four items). These scales were based on a psychometric assessment of the survey in a previous study (Thomas et al. 2003)

Frequency Distribution of Responses on Opinions About Current Practice

There was a good spread in ratings on each of the items in the "Perceptions Scale" (appendix G). When we look at the ratings spread for each individual item, several items have a distribution that is skewed towards the right (after reverse coding the negative statements), which implies that the general opinion leaned more towards agreement with positive views on CDTM. This could interfere with analysis. However the summated scales had a more uniform spread with no pronounced skewness.

Mean Scale Scores for Support for CDTM, Strategic Impact of CDTM, Financial Impact of CDTM and Regulations for CDTM

Means and standard deviations were calculated for each of the 27 survey items. For surveys missing observations for no more than 2 of the 27 items on perceptions regarding CDTM, the mean score on an item was entered for missing values. For surveys missing observations for more than two items, none of the responses were used in the analysis of perceptions regarding CDTM. Items regarding perceptions on CDTM that were negatively worded were reversed scored for analysis and scale scoring. As discussed, the 27 items on the Perceptions Scale were further summated to form four scales, namely, the support for CDTM scale (eight items), the strategic impact of CDTM

scale (three items), the financial impact of CDTM scale (four items), and the regulation affecting CDTM scale (four items). Ratings on each scale were added and divided by the number of items in the scale, to obtain a score ranging from one to five. Scores close to one indicate strong disagreement and scores close to five indicate strong agreement with the opinion on CDTM. Items in the CDTM scale were scored such that higher scores represent more positive impact of CDTM. These scores are summarized in Table 31.

Pharmacy Directors Opinions on the Support from Healthcare Providers

The scale for the "Support for CDTM" had a mean of 3.98±0.54 and a median of 4.0. Scores greater than 3 indicate a positive attitude towards Support from healthcare providers. The closer the scores are to 5, the higher the support. Based on the mean scale scores, pharmacy directors perceived that CDTM was supported by health care providers and hospital administrators.

Pharmacy Directors Opinions on the Strategic Impact of CDTM

The scale for the "Strategic Impact of CDTM" had a mean of 3.87±0.66 and a median of 4.0. Scores greater than 3 indicate a positive attitude towards Support from healthcare providers. The closer the scores are to 5, the higher the support. Since the score is less than 3, it indicates a negative attitude towards the Effect of CDTM Regulations. However, since it is not much less than 3 (2.77), the opinions are not highly negative. Based on the mean scale scores, pharmacy directors perceived that CDTM had a positive strategic impact.

Pharmacy Directors Opinions on the Financial Impact of CDTM

The scale for the "Financial Impact of CDTM" had a mean of 2.94±0.79 and a median of 3.0. Scores greater than 3 indicate a positive attitude towards Support from healthcare providers. The closer the scores are to 5, the higher the support. Based on the mean scale scores, pharmacy directors perceived that CDTM had little or no financial impact.

Pharmacy Directors Opinions on the Effect of CDTM Regulations

The scale for the " Effect of CDTM Regulations " had a mean of 2.77±0.69 and a median of 3.0. Scores greater than 3 indicate a positive attitude towards Support from healthcare providers. The closer the scores are to 5, the higher the support. Since the score is less than 3, it indicates a negative attitude towards the Effect of CDTM Regulations. However, since it is not much less than 3 (2.77), the opinions are not highly negative. Based on the mean scale scores, pharmacy directors perceived that CDTM had suffered slightly due the state regulations.

Associations between Perceptions of CDTM and CDTM use

ANOVA was used to determine if there was any difference in perceptions between hospitals with and without CDTM.

Associations between Support for CDTM scale scores and CDTM

The ANOVA test found significant associations between the Support for CDTM Scale and CDTM ($p<0.0001$). Pharmacy Directors for hospitals with collaborative drug therapy management had a mean score of 4.19 for the Support scale which was

Table 31. Perceptions of Collaborative Drug Therapy Management.

Response	Mean	Standard Deviation	Minimum	Maximum	Median
Support for CDTM	3.9	0.4	1.3	4.5	3.3
Strategic Impact of CDTM	3.8	0.5	2.1	5.0	4.0
Financial Impact of CDTM	2.9	0.8	1.0	5.0	3.0
Regulations for CDTM	2.7	0.7	1.0	5.0	3.0

[1]Mean based on an average score of scale items where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.

[2]p-values based on ANOVA comparison tests between hospitals that had CDTM and hospitals that did not have CDTM. p-value<0.05 is considered significant.

significantly higher than the mean score for Pharmacy Directors at hospitals without CDTM (3.58), meaning that they perceived greater support for CDTM as compared to pharmacy directors of hospitals without CDTM.

Associations between Strategic Impact of CDTM scale scores and CDTM

The ANOVA test found significant associations between the Strategic Impact of CDTM Scale and CDTM ($p<0.0001$). Pharmacy Directors for hospitals with collaborative drug therapy management had higher mean scores for the Strategic impact scale at 4.06, meaning that they perceived greater strategic impact of CDTM as compared to pharmacy directors of hospitals without CDTM, who had a mean score of 3.05 for the same scale.

Associations between Financial Impact of CDTM scale scores and CDTM

The ANOVA test did not find any significant associations between the Financial Impact of CDTM Scale and CDTM ($p=0.35$). Pharmacy directors' perceptions of the financial impact of CDTM was not dependent on whether or not their hospital had CDTM.

Associations between Financial Impact of CDTM scale scores and CDTM

The ANOVA test did not find any significant associations between the Financial Impact of CDTM Scale and CDTM ($p=0.35$). Pharmacy directors' perceptions of the financial impact of CDTM was not dependent on whether or not their hospital had CDTM.

Associations between Effect of CDTM Regulations scale scores and CDTM

The ANOVA test did not find any significant associations between the Effect of CDTM Regulations Scale and CDTM ($p=0.35$). Pharmacy directors' perceptions of the impact of CDTM regulations was not dependent on whether or not their hospital had CDTM.

Associations between Hospital Characteristics and Pharmacy director Perceptions of CDTM

Analysis of variance was used to determine associations between Pharmacy Director Perceptions of CDTM and the demographic characteristics of the hospital.

Associations between Hospital Characteristics and Support for CDTM scale scores

Significant associations were found between the support for CDTM and institution ownership, bed size, and the population of the city in which the institution was located ($p<0.05$). Items in the CDTM scale were scored such that higher scores represent more positive impact of CDTM. Newman-Keuls multiple means comparison tests found a significant difference between Private (Non-Profit) and Government hospitals only. Pharmacy directors for private (Non-Profit) hospitals perceived greater support for CDTM from the hospital staff as compared to pharmacy directors in hospitals owned by the government (4.1 vs. 3.8 respectively). Hospitals with six to forty-nine beds had significantly lower perceptions of support for CDTM at 3.8 compared to hospitals with more than fifty beds (4.04 to 4.1). Similarly, pharmacy directors at hospitals in cities with less than 5,000 people had significantly lower scores for the Support for CDTM scale at 3.7 when compared to hospitals in cities with more than 100,000 people (4.0).

Table 32. Mean Scale Scores for Support for CDTM, Strategic Impact of CDTM, Financial Impact of CDTM and Regulations for CDTM

	Mean Scores for Hospitals		
Response	With CDTM	Without CDTM	p-value
Support for CDTM	4.19	3.58	<0.001
Strategic Impact of CDTM	4.06	3.05	<0.001
Financial Impact of CDTM	2.97	2.87	0.350
Regulations for CDTM	2.79	2.75	0.680

[1]Mean based on an average score of scale items where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.

[2]p-values based on ANOVA comparison tests between hospitals that had CDTM and hospitals that did not have CDTM. p-value<0.05 is considered significant.

Associations between Hospital Characteristics and Strategic Impact of CDTM scale scores

Significant associations were found between the strategic impact of CDTM and institution ownership, bed size, and the population of the city in which the institution was located ($p<0.05$). Items in the CDTM scale were scored such that higher scores represent more positive impact of CDTM. Newman-Keuls multiple means comparison tests found a significant difference between Private and Government hospitals only. Hospitals with six to forty-nine beds had significantly lower perceptions of impact of CDTM at 3.6 compared to hospitals with more than fifty beds (3.9 to 4.0). Similarly, pharmacy directors at hospitals in cities with less than 5,000 people had significantly lower scores for the Impact of CDTM scale at 3.4 when compared to hospitals in cities with more than 100,000 people (3.8).

Associations between Hospital Characteristics and Financial Impact of CDTM scale scores

No significant associations were found between the financial impact of CDTM and any hospital characteristic including institution ownership, institution classification, bed size, and the population of the city in which the institution was located ($p>0.05$).

Associations between Hospital Characteristics and CDTM Regulations scale scores

No significant associations were found between the CDTM Regulations scale scores and any hospital characteristic including institution ownership, institution classification, bed size, and the population of the city in which the institution was located ($p>0.05$).

Associations between Pharmacy director Perceptions of CDTM and Pharmacy Director Characteristics

Analysis of variance was used to determine associations between Pharmacy Director Perceptions of CDTM and the demographic characteristics of the respondents.

Associations between Pharmacy Director Characteristics and Support for CDTM scale scores

Significant associations were found between the support for CDTM scale scores and Pharmacy Director certification and degree ($p<0.05$). Pharmacy directors who had completed some certification related to the field perceived greater support for CDTM at their facilities compared to pharmacy directors that did not have any certification (4.1 vs. 3.9 respectively). Pharmacy directors that had a Pharm.D. or a Doctor of Pharmacy degree had significantly higher scores for the Support for CDTM scale as compared to pharmacy directors with any other degree (4.0 vs. 3.9 respectively).

Associations between Pharmacy Director Characteristics and Strategic Impact of CDTM scale scores

Significant associations were found between the support for CDTM scale scores and Pharmacy Director certification ($p=0.02$). Newman-Keuls multiple means comparison tests found that pharmacy directors who had completed some certification related to the field perceived greater strategic impact of CDTM at their facilities compared to pharmacy directors that did not have any certification (4.0 vs. 3.8 respectively).

Table 33. Associations between Support for CDTM and Hospital Characteristics

Hospital Characteristic	Number[2]	Mean	NK Grouping		F-value	p-value[1]
Institution Ownership (N=269)					5.19	0.006
Private nonprofit	139	4.08		A		
Private for profit	70	3.91	B	A		
Government	60	3.83	B			
Institution Classification (N=269)					1.68	0.171
Short-term general	194	4.00		A		
Long-term general	19	3.80		A		
Psychiatric	16	3.76		A		
City Population (N=265)					4.54	0.002
Less than 4,999	28	3.71	B			
5,000 to 24,999	81	3.86	B	A		
25,000 to 99,999	66	4.10		A		
100,000 to 499,999	49	4.04		A		
More than 500,000	41	4.12		A		
Bed Size (N=266)					5.18	0.002
6 to 49	96	3.81	B			
50 to 99	53	4.06		A		
100 to 199	48	4.04		A		
200 to 599	69	4.11		A		

[1]p-value<0.05 is considered significant

[2]Number (N) varies from 265 to 269 due to non response.

Table 34. Associations between Strategic Impact of CDTM and Hospital Characteristics

Hospital Characteristic	Number[2]	Mean	NK Grouping		F-value	p-value[1]
Institution Ownership (N=264)					50.07	<0.001
Private nonprofit	138	3.94		A		
Private for profit	68	3.90		A		
Government	58	3.68	B			
Institution Classification (N=264)					1.10	0.171
Short-term general	190	3.91		A		
Long-term general	19	3.67		A		
Psychiatric	16	3.70		A		
City Population (N=260)					4.28	0.002
Less than 4,999	27	3.44	B			
5,000 to 24,999	79	3.81		A		
25,000 to 99,999	66	3.96		A		
100,000 to 499,999	49	3.97		A		
More than 500,000	39	4.01		A		
Bed Size (N=269)					6.03	0.001
6 to 49	93	3.65	B			
50 to 99	51	3.91		A		
100 to 199	48	4.01		A		
200 to 599	69	4.03		A		

[1]p-value<0.05 is considered significant

[2]Number (N) varies from 260 to 269 due to non response.

Table 35. Associations between Financial Impact of CDTM and Hospital Characteristics

Hospital Characteristic	Number[2]	Mean	NK Grouping	F-value	p-value[1]
Institution Ownership (N=260)				0.20	0.812
Private nonprofit	136	2.93	A		
Private for profit	66	2.93	A		
Government	57	2.93	A		
Institution Classification (N=259)				1.10	0.170
Short-term general	188	2.97	A		
Long-term general	19	2.84	A		
Psychiatric	16	2.96	A		
City Population (N=256)				0.93	0.453
Less than 4,999	27	2.81	A		
5,000 to 24,999	79	2.77	A		
25,000 to 99,999	66	2.85	A		
100,000 to 499,999	49	2.80	A		
More than 500,000	39	2.58	A		
Bed Size (N=257)				0.90	0.437
6 to 49	93	3.06	A		
50 to 99	51	2.94	A		
100 to 199	48	2.86	A		
200 to 599	69	3.06	A		

[1]p-value<0.05 is considered significant

[2]Number (N) varies from 256 to 260 due to non response.

Table 36. Associations between Regulations for CDTM and Hospital Characteristics

Hospital Characteristic	Number[2]	Mean	NK Grouping	F-value	p-value[1]
Institution Ownership (N=264)				1.44	0.239
Private nonprofit	136	2.93	A		
Private for profit	66	2.93	A		
Government	57	2.93	A		
Institution Classification (N=264)				1.75	0.156
Short-term general	188	2.97	A		
Long-term general	19	2.84	A		
Psychiatric	16	2.96	A		
City Population (N=260)				1.00	0.410
Less than 4,999	27	2.81	A		
5,000 to 24,999	79	2.77	A		
25,000 to 99,999	66	2.85	A		
100,000 to 499,999	49	2.80	A		
More than 500,000	39	2.58	A		
Bed Size (N=262)				1.42	0.237
6 to 49	93	3.06	A		
50 to 99	51	2.94	A		
100 to 199	48	2.86	A		
200 to 599	69	3.06	A		

[1]p-value<0.05 is considered significant

[2]Number (N) varies from 260 to 264 due to non response.

Associations between Pharmacy Director Characteristics and Financial Impact of CDTM scale scores

No significant associations were seen between the financial impact for CDTM scale scores and Pharmacy Director certification characteristics. This implies that there was no difference in mean scores for the Financial Impact scale between pharmacy directors with different pharmacy director characteristics. This implies that there was no difference between the two groups in terms of their perceptions of what the financial impact of CDTM has been.

Associations between Pharmacy Director Characteristics and CDTM Regulations scale scores

No significant associations were seen between the CDTM Regulations scale scores and any pharmacy director characteristic including age, gender, licensure time, degree or certification obtained or residency completed ($p>0.05$). This implies that there was no difference between the two groups in terms of their perceptions of how CDTM Regulations have affected practice.

Future plans for CDTM activities.

Tables 41 and 42 provide data on the short-term (within one year) and the long-term (beyond one year) plans of hospitals for changes in various aspects of CDTM. In terms of the distribution of responses, the distribution was heavily skewed towards the right, with almost no respondents choosing the "Large decrease" or "Slight Decrease" option on the rating scale. However looking at the responses can give us a good idea of the trends.

Table 37. Associations between Support for CDTM and Pharmacy Director Characteristics

Pharmacy Director Characteristic	Number[2]	Mean	NK Grouping	F-value	p-value[1]
Gender (N=264)				0.67	0.512
Female	106	3.97	A		
Male	157	3.99	A		
Age (N=260)				0.92	0.450
Less than 34 years	23	4.03	A		
35 to 44 years	60	4.00	A		
45 to 54 years	63	4.01	A		
55 to 64 years	102	3.98	A		
More than 65 years	12	3.69	A		
Residency (N=269)				0.97	0.326
Yes	45	4.06	A		
No	224	3.97	A		
Pharm.D. (N=261)				4.87	0.020
Degree	136	4.05	A		
No degree	135	3.90	B		
Certification (N=252)				5.21	0.023
Yes	62	4.12	A		
No	197	3.93	B		

[1]p-value<0.05 is considered significant

[2]Number (N) varies from 252 to 269 due to non response.

Table 38. Associations between Strategic Impact of CDTM and Pharmacy Director Characteristics

Pharmacy Director Characteristic	Number[2]	Mean	NK Grouping	F-value	p-value[1]
Gender (N=264)				0.62	0.538
Female	103	3.84	A		
Male	153	3.90	A		
Age (N=260)				0.96	0.430
Less than 34 years	22	3.83	A		
35 to 44 years	58	3.91	A		
45 to 54 years	63	3.80	A		
55 to 64 years	99	3.94	A		
More than 65 years	11	3.60	A		
Residency (N=269)				0.50	0.480
Yes	44	3.94	A		
No	218	3.86	A		
Pharm.D. (N=261)				0.15	0.700
Degree	136	4.05	A		
No degree	135	3.99	A		
Certification (N=252)				5.21	0.0230
Yes	59	4.05	A		
No	193	3.83	B		

[1]p-value<0.05 is considered significant

[2]Number (N) varies from 252 to 269 due to non response.

Table 39. Associations between Financial Impact of CDTM and Pharmacy Director Characteristics

Pharmacy Director Characteristic	Number[2]	Mean	NK Grouping	F-value	p-value[1]
Gender (N=264)				0.52	0.592
Female	99	2.88	A		
Male	152	2.98	A		
Age (N=260)				0.34	0.852
Less than 34 years	22	2.82	A		
35 to 44 years	54	2.89	A		
45 to 54 years	63	2.94	A		
55 to 64 years	98	2.99	A		
More than 65 years	11	2.82	A		
Residency (N=269)				0.00	0.952
Yes	44	2.94	A		
No	218	2.86	A		
Pharm.D. (N=261)				2.33	0.128
Degree	136	2.85	A		
No degree	135	2.99	A		
Certification (N=247)				0.00	0.994
Yes	59	2.85	A		
No	193	2.83	A		

[1]p-value<0.05 is considered significant

[2]Number (N) varies from 247 to 269 due to non response.

Table 40. Associations between Regulations for CDTM and Pharmacy Director Characteristics

Pharmacy Director Characteristic	Number[2]	Mean	NK Grouping	F-value	p-value[1]
Gender (N=257)				0.91	0.402
Female	106	3.97	A		
Male	157	3.99	A		
Age (N=260)				1.79	0.131
Less than 34 years	22	3.83	A		
35 to 44 years	58	3.91	A		
45 to 54 years	63	3.80	A		
55 to 64 years	99	3.94	A		
More than 65 years	11	3.60	A		
Residency (N=269)				0.08	0.784
Yes	44	3.94	A		
No	218	3.86	A		
Pharm.D. (N=261)				0.00	0.948
Degree	136	4.05	A		
No degree	135	3.99	A		
Certification (N=247)				0.01	0.9286
Yes	59	4.05	A		
No	193	3.83	A		

[1]p-value<0.05 is considered significant

[2]Number (N) varies from 260 to 264 due to non response.

Since the data is heavily skewed towards "increase", we can conclude that in the short-term, hospitals with CDTM planned to increase the numbers of staff pharmacists involved in CDTM, CDTM protocols, and diseases or areas for which pharmacists provide CDTM. These hospitals also had long-term plans to increase the number of CDTM protocols and diseases or areas for which pharmacists provide CDTM. Looking at the mean and median scores obtained, it can be seen that the hospitals indicated larger planned increases in the long term than in the short term. 4.8 percent of hospitals had plans for a large increase in the number of CP protocols in the short term as opposed to 18.42 percent of hospitals that had plans for a large increase in the long term. Similarly, 6.02 percent of hospitals had plans for a large increase in the number of diseases or treatments their hospital authorized CDTM for in the short term as opposed to 18.42percent of hospitals that had plans for a large increase in the number of disease or treatment areas for CDTM in the long term. So more hospitals had plans for a long term increase than for a short term increase in CDTM. This is also reflected in the mean scores for short term and long term plans.

Perceived Barriers and Facilitators for CDTM.

Table 43 lists perceived barriers for CDTM and Table 44 lists perceived facilitators for CDTM as mentioned by respondents. Lack of support from physicians and other medical staff (33.8 percent), shortage of pharmacists (26.3 percent), financial or reimbursement issues (12.6 percent), and pharmacist time constraints (12.1 percent) were cited as the most frequent barriers to adopting CDTM. Physician and other medical staff support (42.2), upper administration support (14.2), and improvement in patient

Table 41. Plans regarding Collaborative Drug Therapy Management.

Response	Percent of Respondents Choosing Each Response				
	Large Decrease	Slight Decrease	No Change	Slight Increase	Large Increase
Short Term Plans[1]					
Number of staff pharmacists involved	0.75	3.00	65.54	26.22	4.49
Number of CP protocols	0.00	1.12	46.82	47.19	4.87
Number of diseases/ therapies in which pharmacist provide CP	0.00	0.75	45.49	47.74	6.02
Long Term Plans[2]					
Number of staff pharmacists involved	0.38	1.13	50.94	36.23	11.32
Number of CP protocols	0.38	0.00	33.83	47.37	18.42
Number of diseases/ therapies in which pharmacist provide CP	0.38	0.00	27.55	53.58	18.49

[1]Short Term Plans are plans for the next one year

[2]Long Term Plans are plans beyond one year

Table 42. Means, Standard Deviation, Minimum, Maximum and Medians of Plans Regarding Collaborative Drug Therapy Management.

Response	Percent of Respondents Choosing Each Response				
	Mean	Standard Deviation	Minimum	Maximum	Median
Short Term Plans					
Number of staff pharmacists involved	3.3	0.6	1.0	5.0	3.0
Number of CP protocols	3.5	0.6	2.0	5.0	4.0
Number of diseases/ therapies in which pharmacist provide CP	3.5	0.6	2.0	5.0	4.0
Long Term Plans					
Number of staff pharmacists involved	3.5	0.7	1.0	5.0	3.0
Number of CP protocols	3.8	0.7	1.0	5.0	4.0
Number of diseases/ therapies in which pharmacist provide CP	3.9	0.7	1.0	5.0	4.0

[1]Short Term Plans are plans for the next one year

[2]Long Term Plans are plans beyond one year

outcomes/reduction in medication errors (10.2 percent) were the most frequently mentioned facilitators of CDTM. It is worth noting that physician support was both the most commonly cited facilitator as well as the most commonly cited barrier to CDTM (lack of physician support).

Comparison of Current Extent of CDTM with that in 2003

Since this study is the first to utilize the survey developed and validated by Thomas and colleagues for their survey of collaborative drug therapy management in hospitals (Thomas et al. 2003), comparing the results obtained in both surveys can give an estimate of the change in the extent of CDTM in U.S. hospitals over the last decade. The proportion of CDTM in hospitals reported in the 2003 study was compared with the proportion of CDTM in hospitals in this study using Chi-Square tests. The 2003 study had reported that 50 percent of all respondent hospitals had CDTM.. In this study, 66 percent of all respondent hospitals had CDTM. This is a statistically significant increase from the proportion in 2003 ($p<0.001$). Hence we can conclude that there has been an increase in the extent to which CDTM is used in U.S. hospitals over the last 10 years

Tests for Response Bias

To test for potential non-response bias, the first third of respondents were compared with the last third of respondents. Based on 'the continuum of resistance model' late respondents can be used as a proxy for non-respondents in estimating non-response bias, while early respondents are indicative of all respondents, hence the difference between the two will reflect the non-response bias (Voogt et al. 1998).

Table 43. Perceived Barriers to CDTM

Perceived Barriers	Number of Respondents (N=198)	Percentage of Respondents
Shortage of pharmacists	52	26.26
Lack of support from physicians/medical staff	67	33.84
Financial or reimbursement issues	25	12.63
Pharmacist time constraint	24	12.12
Pharmacist competencies	18	9.09
Lack of upper administration support	10	5.05
State legislation constraint	18	9.09
Pharmacists' unwillingness	15	7.58
Lack of interest/understanding	7	3.54
Lack of resources	28	14.14
Technology constraints	2	1.01
Lack of appropriate protocols	2	1.01
Safety concerns	1	0.51

Table 44. Perceived Facilitators to CDTM

Perceived Facilitators	Number of Respondents (N=218)	Percentage of Respondents
Physicians' and other medical staff's support	92	42.20
Pharmacist competence	13	5.96
Good relationship with healthcare providers	11	5.05
Upper administration support	31	14.22
Pharmacists' desire	17	7.80
Improved patient outcomes/reduction in errors	23	10.55
Physician lack of time	10	4.59
Legislation	7	3.21
Financial gains	9	4.13
Patient satisfaction	3	1.38
Clinical rounds	3	1.38
Formulary	3	1.38
Technology	2	0.92

Chi-square tests were used to compare categorical variables for early respondents and late respondents and Analysis of Variance tests were used to compare continuous variables for early and late respondents. The characteristics of early and late respondents that were compared were the proportion of hospitals that engaged in CDTM, perceptions regarding CDTM, hospital characteristics, and pharmacy directors' characteristic. There were no significant differences found between early and late respondents for any of the demographic characteristics. However the early respondents had a significantly higher mean score for "Support for CDTM" as compared to the later respondents.

In addition to comparing early and late respondents, the sample distribution on the basis of the number of beds in the hospitals (Bed Size) was compared to the distribution of bed sizes of the population. The purpose of doing this was to determine whether the random sample that had been drawn differed significantly from the rest of the population in terms of demographic characteristics. Bed Size was used as the parameter since bed size data was available for respondents as well as non respondents. No significant differences were found between the bed size distribution of our sample and the rest of the population. This implies that no significant evidence for non response bias was seen.

Notes

Thomas, J., M. Bharmal, S.-W. Lin and Y. Punekar (2006). "Survey of pharmacist collaborative drug therapy management in hospitals." American Journal of Health-System Pharmacy 63(24): 2489-2499.

Voogt, Robert J.J. and Saris, Willem E. and Niemoller, B. (1998). "Non-response, and the gulf between the public and the politicians." Acta politica, 33: pp. 250-280. ISSN 0001-6810

SUMMARY AND DISCUSSION

The overall objective of the project was to study the extent and scope of collaborative drug therapy management (CDTM) in U.S. hospitals as well as pharmacy directors' perceptions regarding CDTM. There were four specific objectives of this study: 1) to assess the current extent, scope and perceptions of CDTM in U.S. hospitals, 2) to determine the associations between hospital characteristics, pharmacy director characteristics, and perceptions of CDTM, 3) to investigate hospitals' short-term and long-term plans regarding CDTM and 4) to identify pharmacy directors' views about the major facilitators and barriers for CDTM in hospitals.

A mail survey developed and validated by Thomas et al. (Thomas et al. 2006) was used to collect data. The mail survey asked respondents to indicate whether any pharmacists in their hospital were engaged in CDTM or collaborative practice that involved the initiation or modification of drug therapy and contained specific questions the extent and scope of CDTM activities in their institution. The survey also had two additional open-ended questions that ask the respondents what they perceive to be the greatest barrier to CDTM as well as the greatest facilitator of CDTM.

Pharmacy directors' opinions on CDTM were assessed using twenty-seven items in the survey developed and validated by Thomas et al. The items assessed respondents' opinions about the range and scope of practice in CDTM (six items), the support for CDTM by other health care providers and administrators in the hospital (nine items), the

strategic value provided by collaborative practice to the pharmacy (three items), any financial value created by collaborative practice (five items), and nature of current state regulations that affect collaborative practice (four items). Pharmacy director perceptions of CDTM were assessed using four scales of the CDTM scale: the support for CDTM scale (eight items), the strategic impact of CDTM scale (three items), the financial impact of CDTM scale (four items), and the regulations affecting CDTM scale (four items). The support for CDTM scale assesses pharmacy director perceptions about the support for CDTM activities from the hospital staff, including medical staff and upper administration (Thomas et al. 2003). Plans regarding CDTM were assessed using six items in the survey that collected information on whether the respondents had any plans to make changes in the categories: (1) number of staff pharmacists involved in CP, (2) number of CP protocols and (3) number of diseases/ therapies in which pharmacist provide CP. Each item was rated on a 5 point Likert scale previously described, that ranged from large decrease to large increase. Means and standard deviations were calculated for each of the items and the percentage of respondents indicating each response was also calculated. Associations between hospital and pharmacy directors characteristics and CDTM use were tested using chi square tests and logistic regression. Analysis of variance was used to determine associations between Pharmacy Director Perceptions of CDTM and the demographic characteristics of the hospital. Newman-Keuls multiple means comparison tests were used for Post-hoc analysis in case of significant ANOVA tests. To test for potential non-response bias, the first third of respondents were compared with the last third of respondents on the basis of the proportion of hospitals that engaged in CDTM, perceptions regarding CDTM, hospital characteristics, and pharmacy directors'

characteristics, and the sample distribution on the basis of the number of beds in the hospitals (Bed Size) was compared to the distribution of bed sizes of the population.

Sample

Surveys were completed by 283 out of 945 individuals who received surveys and satisfied inclusion and exclusion criteria, a response rate of 30.1 percent. A majority of the hospitals in the study sample were privately owned (89%) and classified as Short Term-General (73%). The maximum concentration of hospitals was in cities with 5,000 to 250,000 people (183 hospitals, 68.3 percent). Most pharmacy directors were over 45 years of age (63%) and approximately 60 percent of the participants were females. 72.5 percent of all respondents, had received their license to practice Pharmacy more than fifteen years prior to the study. Most pharmacy directors had not completed a residency (85%). Approximately half of the respondents had a Doctor of Pharmacy degree, while 56.7 percent of respondents had a Bachelor of Science in Pharmacy degree.

Extent and Scope of CDTM

Approximately sixty-five percent of U.S. hospitals authorized some of their pharmacists to engage in CDTM and sixty-six percent of all pharmacists employed at the hospitals were involved in providing CDTM services to patients. A majority of the hospitals (60%) had written protocols in place for CDTM, which were mostly disease or treatment specific (37%), or general for several diseases or treatments (30%).

A similar study conducted by Thomas and colleagues in 2003 had found that approximately half of all U.S. hospitals had some pharmacists engaged in CDTM (Thomas et al. 2003). Findings from this study indicate that the proportion of hospitals

that allow pharmacists to participate in CDTM over the last ten years has gone up by sixteen percentage points. Such a result is in keeping with expectations of CDTM use increasing over the last decade with the increase in the number of states that have state laws and regulations enabling pharmacists to engage in CDTM from 16 states in 1996 (Shefcheck and Thomas,1996) to 48 states with CDTM laws in 2014 (Weaver 2014). However the 2003 study found that almost eighty percent of all hospitals had written protocols in place for collaborative practice (Thomas et al. 2003), while this study had only sixty percent of all respondents indicating that their hospital had written protocols. So it would appear that the number of hospitals allowing CDTM has grown at a higher rate than the rate at which hospitals are introducing written protocols to regulate CDTM.

CDTM Activities

Most hospitals with CDTM allowed pharmacists to order laboratory tests [58.7% of all hospitals, 95% confidence interval for the percentage being (53 - 64.4)], adjust drug strength [57.9% of all hospitals, 95% confidence interval for the percentage being (52.0 - 63.8)] and change frequency of administration of drugs [53.8% of all hospitals, 95% confidence interval for the percentage being (48.0 - 59.6)]. However only 34 percent of hospitals allowed pharmacists to discontinue a drug, and approximately the same percentage of the hospitals (30.4%) allowed their pharmacists to initiate drug therapy.

Findings from this study are consistent with past literature. In a 1996 study by Fuller and colleagues, it was found that most CDTM protocols involved continuation of drug therapy or authorizing renewals, while initiation of therapy was the least commonly seen (Fuller et al. 2003). In 2003, Thomas and colleagues surveyed U.S. hospitals and

reported that most of the hospitals with CDTM authorized pharmacists to adjust a drug's strength, order laboratory or related tests, and change a drug's frequency of administration. However, only 31.6 percent of the CDTM hospitals allowed pharmacists to discontinue a drug, and less than half of the CDTM hospitals (42.4%) allowed their pharmacists to initiate drug therapy. These trends are similar to the trends seen in this study with adjusting a drug's strength, ordering laboratory or related tests, and changing a drug's frequency of administration still being the most common activities and initiating drug therapy being one of the least common activities. However the percentage of hospitals allowing pharmacists to initiate drug therapy has reduced even more since 2003.

It was also seen that hospitals mostly permitted CDTM for the treatment/disease categories of Anticoagulation [52.4%, (95 % confidence interval = 46.7% - 58.1%)], Infectious Diseases [44.8%, (95 % confidence interval =39.0% - 50.6%)] and Parenteral Nutrition [32.6% (95 % confidence interval =27.2% - 38.0%)]. These findings are mostly consistent with those reported by Thomas and colleagues in 2003, who found that hospital pharmacists were most frequently involved in CDTM for infectious diseases or antibiotic therapy, anticoagulation, and parenteral nutrition, in that order. While the three most common treatment areas has remained consistent over the last decade, this study found that anticoagulation therapy was now the most commonly provided therapy by CDTM pharmacists as opposed to infectious disease therapy in 2003.

Reimbursement for CDTM activities

Of the 276 responses received, only twenty-five pharmacy directors indicated that patients were charged a fee for CDTM services, which means that only nine percent of

the respondent hospitals were charging any kind of fee to patients for CDTM activities performed by a pharmacist. Nineteen (82.6 percent) of these hospitals only charged outpatients for CDTM services.

In 2003, Thomas and colleagues reported that just over twelve percent of the hospitals with CDTM surveyed charged patients a fee for CDTM activities performed by a pharmacist. Findings from this study indicate that re-imbursement for CDTM activities is still very low, with only nine percent of respondent hospitals reporting charging patients a fee for CDTM activities.

Associations between Hospital and Pharmacy Director Characteristics and CDTM Use

Private hospitals were 3.3 times more likely to have CDTM than government hospitals. Likelihood of having CDTM was also positively associated with the population of the city in which the hospital was located as well as the number of beds in the hospital, with hospitals in larger cities and with a greater number of beds having a significantly higher chance of having CDTM as compared to smaller cities and hospitals. A possible reason for this trend could be that larger or city-based hospitals have a larger number of patients admitted and the use of pharmacists to provide care under CDTM in these hospitals may help to increase efficiency by taking on some of the physicians 'workload. Likelihood of a hospital having CDTM was only significantly associated with one Pharmacy Director characteristic. It was found that hospitals with pharmacy directors that had a Pharm.D. degree were twice as likely to have CDTM as hospitals whose pharmacy directors had some other degree.

These findings are mostly consistent with prior literature where hospitals located in bigger cities and hospitals with greater bed sizes beds were reported as being more likely to have CDTM (Thomas e al. 2003). However pharmacy director age has been reported as a significant predictor of the hospital having CDTM in past literature(Thomas et al. 2003) which is inconsistent with this study that did not find any significant associations between pharmacy director age and the likelihood of the hospital having CDTM.

Pharmacy director perceptions of CDTM

Pharmacy directors perceived positive support for CDTM in hospitals from health care providers and hospital administrators. The Chi Square test found significant associations between the Support for CDTM Scale scores and CDTM ($p<0.0001$) and Pharmacy Directors for hospitals with collaborative drug therapy management had higher mean scores for the Support scale, meaning that they perceived greater support for CDTM as compared to pharmacy directors of hospitals without CDTM. This is consistent with what was reported by Thomas and colleagues in 2003 who reported a significant association between the support for CDTM in hospitals and their likelihood of having CDTM. A non-significant Chi-Square test result for associations between the Financial Impact of CDTM scale indicated that respondents perceived little or no financial impact of CDTM, with just over nine percent of the hospitals that reported having some pharmacists engaged in CDTM charging patients a fee for pharmacists' CDTM activities. Similar results have been obtained in studies in other settings. For example, in a study of community pharmacies in North Carolina, less than 21 percent of

pharmacies billed or received reimbursement for pharmaceutical care services provided by pharmacists (Zillich et al. 2002).

However, CDTM was perceived to have a positive strategic impact with the median score for the Strategic Impact of CDTM scale given by pharmacy directors being 4.0 (Scores closer to 5.0 indicated a more positive response). A majority of the respondents agreed that CDTM activities enhance upper administration's perceptions of the value of pharmacists (85%) and facilitate implementation of other pharmacy services (65%). This is consistent with the results of a study by Kwint and colleagues in 2013 who found significant associations between the extent of collaboration between physicians and pharmacists and implementation rate of recommendations arising from medication review (Kwint et al. 2013). CDTM was also perceived to have a positive strategic impact in the 2003 study by Thomas and colleagues indicating that there has been no change in pharmacy director perceptions of the strategic impact of CDTM over the last decade.

Associations between Perceptions of CDTM and CDTM Use

Significant associations exist between pharmacy directors perceptions of the support for CDTM in their hospitals as well as the strategic impact of CDTM with CDTM use. Pharmacy Director scores for perceived support for CDTM in hospitals that had form of CDTM were significantly higher than the Pharmacy Director scores for perceived support for CDTM in hospitals that did not have any pharmacists involved in CDTM. Respondents from hospitals with CDTM also perceived greater strategic impact of CDTM than those from hospitals without CDTM. These findings are consistent with

the results of the 2003 survey of pharmacy directors by Thomas and colleagues (Thomas et al. 2003). Since support for CDTM was also identified as a major facilitator for CDTM, it can be expected that pharmacy directors of hospitals where CDTM is being practiced would perceive greater support for CDTM as compared to hospitals without CDTM.

Associations between Demographic Characteristics and Pharmacy director Perceptions of CDTM

Significant associations exist between the support for CDTM and institution ownership, bed size, and the population of the city in which the institution was located. Pharmacy directors for private (Non-Profit) hospitals perceived greater support for CDTM from the hospital staff as compared to pharmacy directors in hospitals owned by the government. Hospitals with CDTM had significantly higher perceptions of support for CDTM if they had larger bed sizes and were situated in more populated cities. Similarly, significant associations also exist between the strategic impact of CDTM and institution ownership, bed size, and the population of the city in which the institution was located, with pharmacy directors of private hospitals that had a larger number of beds and were situated in more densely populated cities perceiving a significantly higher strategic impact of CDTM as compared to pharmacy directors of government hospitals that were smaller in size. This in turn would cause the upper administration and medical staff at the hospitals to be more supportive of CDTM, which is then perceived by the pharmacy directors as being high.

Significant associations also exist between the support for CDTM scale scores and Pharmacy Director Certification and degree. Newman-Keuls multiple means

comparison tests found that pharmacy directors who had completed some certification related to the field perceived greater support for CDTM at their facilities compared to pharmacy directors that did not have any certification. It was also seen that pharmacy directors that had a Pharm.D. or a Doctor of Pharmacy degree perceived greater support for CDTM as compared to pharmacy directors with any other degree.

Future Plans for CDTM activities

In terms of the distribution of responses to the items on "Plans Regarding CDTM", the distribution was heavily skewed towards the right, with almost no respondents choosing the "Large decrease" or "Slight Decrease" option on the rating scale which indicates that all hospitals surveyed planned in both the short- term and long-term for zero to some increase in the number of staff pharmacists involved in CDTM, number of CDTM protocols, and number of diseases or areas for which pharmacists provide CDTM, and almost no hospitals had plans for a decrease in the number of staff pharmacists involved in CDTM, number of CDTM protocols, and number of diseases or areas for which pharmacists provide CDTM . However, hospitals with CDTM indicated larger planned increases than did hospitals without CDTM. These findings are consistent with past literature where hospitals with CDTM were reported as being more likely to have plans for increase in CDTM involvement in the future (Thomas et al. 2003).

Perceived Barriers and Facilitators for CDTM.

Lack of support from physicians and other medical staff (33.84%), shortage of pharmacists, financial or reimbursement issues (12.63%) and pharmacist time constraints (12.12%) were cited as the most frequent barriers to adopting CDTM. Physician and

other medical staff support (42.20%), upper administration support (14.22%), and improvement in patient outcomes/reduction in medication errors (10.55%) were the most frequently mentioned facilitators of CDTM. It is worth noting that physician support was both the most commonly cited facilitator as well as the most commonly cited barrier to CDTM. It was also seen that pharmacy directors in hospitals with CDTM perceived a higher level of support from their medical staff as did pharmacy directors of hospitals that did not have CDTM. This could be the reason why physician support was identified as both a barrier and a facilitator to CDTM. Pharmacy directors of hospitals with CDTM would be expected to cite physician support as a facilitator while directors of hospitals without CDTM would cite it as a barrier. Since CDTM has been found to be associated with significantly improved patient outcomes, physicians who have had past experience with CDTM would be expected to be more supportive of the practice, which is reflected in these results.

This paradoxical choosing of physician support as both a major barrier and a major facilitator for CDTM was also seen in the 2003 survey by Thomas and colleagues (Thomas et al. 2003). Respondents in the 2003 study identified a shortage of pharmacists and lack of support from physicians and other medical staff as the major perceived barriers to CDTM which are consistent with the finding of this study, although financial or reimbursement issues and pharmacist time constraints were also identified as major barriers to CDTM in this study in addition to the aforementioned barriers.

Limitations

The present study had some limitation. The survey response rate was 30.1 percent. A higher response rate would ensure a better representation of the population. However it is to be noted that evaluation of potential non-response bias indicated that there were no significant differences between early and late respondents in the proportion of hospitals that engaged in CDTM or in perceptions regarding CDTM. The bed size distribution in the sample was also not found to differ significantly from the bed size distribution of the population. Therefore the sample can be assumed to be a good representation of the population. All data collected on the scope and extent of CDTM were based on respondents' self-reports and are dependent on the accuracy of their reports. However, the pharmacy director should be a reliable source for information about the extent and scope of CDTM in a hospital. The perceptions of pharmacy directors were measured using an instrument that has only been used in one prior study. However, the instrument scales demonstrated good internal consistency when validated in a prior study

Implications

Pharmacist CDTM is characterized by an inter-disciplinary approach involving an agreement between patients and physicians to manage drug therapy regimens (Finley 2002), in which qualified pharmacists are "permitted to assume responsibility for performing patient assessments, ordering drug therapy-related laboratory tests, administering drugs; and selecting, initiating, monitoring, continuing, and adjusting drug regimens" (Anaya 2008).

The scope of Pharmacy Practice has expanded over the last ten years (Giberson et al. 2011 ; Taylor 2008). A report to the US Surgeon General in 2009 states that after a patient has received a confirmed diagnosis, the patient health care team generally includes several pharmacists that help the patient to manage their disease and also deliver patent care services as health care providers in the United States (Giberson et al. 2011). However, according to George Halvorson, chairman and CEO of the Kaiser Foundation Health Plan, Inc. clinical pharmacists are still "the most underutilized members of the health care team." (Giberson et al. 2011).

Although past studies have reported significant positive patient outcomes as a result of providing CDTM based care (Gattis 1999; Kalisch 2010; Duncan 2006), the extent and scope of collaborative practice in hospital settings has considerable room for growth. This study findings show that only 65 percent of all hospitals have CDTM. Since implementation of CDTM included pharmacist duties sometimes considered to be outside their normal scope of practice, each state is required to establish state specific laws that control the kind of care provided under CDTM, including the practice sites at which CDTM is allowed, the treatment/disease categories for which collaborative practice protocols can be defined as well as the kind of services pharmacists can provide under CDTM agreements (Finley et al. 2002). The Practice Advisory on Collaborative Drug Therapy Management, which was approved by Academy of Managed Care Pharmacy in February 2012, states that forty-eight states currently have collaborative drug therapy management (CDTM) legislation or regulations (Weaver 2014). However there is considerable variation in the way different states define the pharmacist scope of practice under CDTM. As of 2014, thirty-eight states allow pharmacists to initiate drug

therapy, and forty-five states authorize pharmacists to modify drug therapy. Twenty-nine states make it mandatory for each collaborative agreement protocol to define particular medications or treatment/disease states/conditions for which the pharmacist is authorized to manage drug therapy under that protocol. These limitations on practice are reflected in our study findings which show that the extent of CDTM activities by pharmacists varies with disease or treatment area.

This study found that approximately 65 percent of respondent hospitals had some pharmacists engaged in CDTM. However reimbursement for CDTM activities was only received by nine percent of all hospitals. This could have implications on the future of CDTM because lack of reimbursement for CDTM activities could discourage pharmacists from participating in CDTM. The current push for provider status for pharmacists across the country seeks to address this issue (Weaver 2014). The goal of this campaign is to have pharmacists designated as patient-care providers which would make them eligible to receive reimbursement under Medicare. The passage of this legislation requires an act of Congress, and if passed, it would enable pharmacists to billed for services provided as part of CDTM. California recently became the first state to pass this bill. According to Stacie Maass, APhA Senior Vice President of Pharmacy Practice and Government Affairs, pharmacist involvement in collaborative practice at the state level will be instrumental in the passage of federal legislation that provides provider status to pharmacists since the number of pharmacists already involved in collaborative practice is being highlighted in front of Members of Congress by the pharmacist associations that are currently lobbying for provider status for pharmacists (Weaver 2014). This study's findings provide evidence about the number of pharmacists that are

currently involved in CDTM as well as the kind of activities already being carried out by pharmacists. Although CDTM was not perceived to have any financial impact on pharmacy practice, it was perceived to have a positive strategic impact by raising the value of pharmacists in the eyes of the upper administration regarding and also by making it easier to implement other pharmacy services. If medical staff and upper administration are convinced of the value of pharmacists, they could help in the effort to push for provider status, which would provide incentive for CDTM, which in turn would benefit patients.

In addition to aiding the push for provider status, the study findings also indicate what the major barriers and facilitators to the adoption of CDTM in practice have been so far, as per pharmacy directors. Knowledge of barriers and facilitators could help inform policy change in order to increase the scope of CDTM. Assessing the current opinions of pharmacy directors on various aspects of CDTM can further help in identifying potential barriers or facilitators to the growth of CDTM.

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APPENDICES

Appendix A. Study Survey

SECTION I: ABOUT COLLABORATIVE PRACTICE

1. Collaborative practice, also referred to more specifically as collaborative drug therapy management, often involves initiating or modifying drug therapy. Do pharmacists in your hospital engage in collaborative practice that **involves initiation or modification of drug therapy,** i.e., active intervention beyond a written consult or general therapeutic interchange protocols?

   ☐ Yes
   ☐ No (If no, please go to Section II on Page 3)

2. Please indicate if any pharmacists in your institution are authorized to do each of the following activities and if each activity can be performed for only some patients or for all patients. (Please respond for each item.

Yes	No		For any patient	For certain diseases or therapies only
☐	☐	Initiate drug therapy	☐	☐
☐	☐	Change duration of a drug therapy	☐	☐
☐	☐	Adjust a drug's strength	☐	☐
☐	☐	Change a drug's dosage form	☐	☐
☐	☐	Change a drug's frequency of administration	☐	☐
☐	☐	Change a drug's route of administration	☐	☐
☐	☐	Hold a drug	☐	☐
☐	☐	Discontinue a drug	☐	☐
☐	☐	Order laboratory or related tests	☐	☐
☐	☐	Other (please specify) _____	☐	☐

3. Please indicate the total number of pharmacists employed in your institution and the number of pharmacists in collaborative practice.

   _____ Total number of pharmacists

   _____ Number of pharmacists engaged in collaborative practice that involves initiation or modification of drug therapy

4. Does your institution have written protocols for collaborative practice that involves initiation or modification of drug therapy?

☐ Yes If *yes*, how many? _____ (Please continue to Question 5)
☐ No (If no, please go to Question 6)

5. Please indicate whether protocols in your institution for collaborative practice that involves initiation or modification of drug therapy are disease/treatment specific or general (check all that apply)

☐ Protocols are disease and/or treatment-specific
☐ Protocols are general for several diseases and/or treatments
☐ Other (please specify) _____

6. For what diseases and/or treatments do pharmacists in your hospital engage in collaborative practice that involves initiation or modification of drug therapy, i.e., active intervention beyond a written consult or general therapeutic interchange protocols? (Check all that apply.)

Yes	No		Have written protocol for collaborative practice	Initiate drug therapy	Change duration of a drug therapy	Adjust a drug's strength	Change a drug's dosage form	Change a drug's frequency of administration	Change a drug's route of administration	Hold a drug	Discontinue a drug	Order laboratory or related tests
☐	☐	Anticoagulation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	Diabetes	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	Hypertension	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	Asthma	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	Emergency contraception	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	Dyslipidemias	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	Heart failure	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	Infectious disease	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	General medicine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	Smoking cessation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	Pain management	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

☐	☐	Parenteral nutrition	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	Immunization	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	Other _____	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	Other _____	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	Other _____	☐	☐	☐	☐	☐	☐	☐	☐	☐

7. Are patients charged a fee for any pharmacists' collaborative practice activities?

☐ Yes If yes, ☐ inpatient only ☐ outpatient only ☐ inpatient and outpatient
☐ No

8. Does your pharmacy receive insurance reimbursement for any collaborative practice activities?

☐ Yes (If yes, please specify which activities.)

_____

☐ No

_____

Section II. Opinions About Current Practice

Based on your experience, please indicate your agreement or disagreement with each of the following statements about collaborative practice that involves pharmacist initiation or modification of drug
therapy, i.e., active intervention beyond a written consult or genera interchange protocols, (CP) by rating each item from 1 to 5 where 2=Disagree, 3= Neutral, 4= Agree,
and 5 =Strongly agree.

Range and Type of Activities	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. The range of diseases in which collaborative practice involving pharmacist initiation or modification of drug therapy (CP) is applied is too narrow	1	2	3	4	5
2. Pharmacists who provide CP have access to necessary patient medical records without any difficulty	1	2	3	4	5
3. Pharmacist should have prescribing authority independent of physician-approved protocol	1	2	3	4	5
4. The range of decisions that may be made for patients in which CP occurs is too broad	1	2	3	4	5

Section II. Opinions About Current Practice Cont'd

5. My hospital's protocols on CP are clear	1	2	3	4	5
6. My hospital's protocols on CP are too restrictive	1	2	3	4	5

Support for CP

1. Upper hospital administration is supportive of CP	1	2	3	4	5
2. Physicians in my institution are not supportive of CP	1	2	3	4	5
3. The pharmacy staff is supportive of CP	1	2	3	4	5
4. CP enhances the relationship between pharmacists and physicians	1	2	3	4	5
5. I am supportive of our pharmacists being involved in CP					
6. CP impairs relationships between pharmacists who provide CP and those who do not	1	2	3	4	5
7. My management staff is supportive of our pharmacists being involved in CP	1	2	3	4	5
8. Nurses are supportive of our pharmacists being involved in CP	1	2	3	4	5
9. Patients appear comfortable with the expanded role of pharmacists in CP	1	2	3	4	5

Effects of CP

1. Providing collaborative services enhances upper administration's perceptions of the value of pharmacists	1	2	3	4	5
2. CP has facilitated implementation of other pharmacy services	1	2	3	4	5
3. Physicians have asked my staff pharmacists to provide more advanced services because of CP	1	2	3	4	5

Financial

1. CP has helped pharmacy maintain resources	1	2	3	4	5
2. Third party payers provide reimbursement for some CP activities	1	2	3	4	5
3. CP has helped pharmacy obtain more funds for staff salaries	1	2	3	4	5
4. CP has helped pharmacy limit reductions in resources	1	2	3	4	5
5. CP has helped the pharmacy department obtain more resources	1	2	3	4	5

Regulation affecting CP

1. Current state regulations on CP are too restrictive	1	2	3	4	5

2. Current state regulations on CP encourage CP	1	2	3	4	5
3. Current state regulations on CP do not need changes	1	2	3	4	5
4. Current regulations on CP inhibit CP	1	2	3	4	5

Section III: Future Plans for CP

1. Please indicate your **short-term plans (within one year)** for CP by rating each of the following based on the scale where 1= "large decrease" and 5="large increase."	Large decrease	Slight decrease	No change	Slight Increase	Large increase
a) Number of staff pharmacists involved in CP	1	2	3	4	5
b) Number of CP protocols	1	2	3	4	5
c) Number of diseases/ therapies in which pharmacist provide CP	1	2	3	4	5

2. Please indicate your **long-term plans (beyond one year**) for CP by rating each of the following based on the scale where 1= "large decrease" and 5="large increase."	Large decrease	Slight decrease	No change	Slight Increase	Large increase
a) Number of staff pharmacists involved in CP	1	2	3	4	5
b) Number of CP protocols	1	2	3	4	5
c) Number of diseases/ therapies in which pharmacist provide CP	1	2	3	4	5

3. What has been the greatest barrier to CP?

_____

4. What has been the greatest facilitator to CP?

_____

Section IV: Demographics

Part A- About your institution

1. Please indicate which of the following best describes your institution's ownership?

   ☐ Private (Non-profit)
   ☐ Private (For-profit)
   ☐ Government (City, county, state)

2. Please indicate which of the following best describes your institution's classification:

   ☐ Short-term general and other special
   ☐ Long-term general and other special
   ☐ Psychiatric (Mental health institution)
   ☐ TB and other respiratory diseases
   ☐ Other (please specify) _____

3. Please indicate the population of the city in which your institution is located.

   ☐ Less than 1,000
   ☐ 1,000 to 1,499
   ☐ 1,500 to 2,499
   ☐ 2,500 to 4,999
   ☐ 5,000 to 9,999
   ☐ 10,000 to 24,999
   ☐ 25,000 to 49,999
   ☐ 50,000 to 99,999
   ☐ 100,000 to 249,999
   ☐ 250,000 to 499,999
   ☐ 500,000 to 999,999
   ☐ More than 1 million

4. Please indicate the number of beds in your hospital.

   ☐ 6 to 24
   ☐ 25 to 49
   ☐ 50 to 99
   ☐ 100 to 199
   ☐ 200 to 299
   ☐ 300 to 399
   ☐ 400 to 499
   ☐ More than 500

5. What was the total number of patient-days in your hospital last year? _____

(please see back of this sheet for last page)

Part B-About you

1. Please indicate your gender.

   ☐ Female
   ☐ Male

2. Please indicate your age.

   ☐ Less than 25 years
   ☐ 25 to 34 years
   ☐ 35 to 44 years
   ☐ 45 to 54 years
   ☐ 55 to 64 years
   ☐ More than 65 years

3. Please indicate educational degree(s) you have obtained (check all that apply)

   ☐ Doctor of Pharmacy
   ☐ BS in Pharmacy
   ☐ M.S.
   ☐ Ph.D.
   ☐ Other (please specify) _____

4. Have you completed any pharmacy residency?

   ☐ Yes If yes, ☐ General (pharmacy practice) ☐ Specialty Total Number completed ___
   ☐ No

5. How long has it been since you were first licensed to practice pharmacy?

   ☐ Less than 1 year
   ☐ 1 to 3 years
   ☐ 3 to 5 years
   ☐ 5 to 10 years
   ☐ 10 to 15 years
   ☐ More than 15 years

6. Do you have any special certification or recognition in pharmacy

   ☐ Yes, the certification or recognition is _____
   ☐ No

Comments:

Please use the space below and the following page to share any comments regarding pharmacist collaborative practice. The information you provide will be kept confidential.

No postage is required to return this survey. Simply refold it with the business reply side out, use a small piece of tape to keep it together and place it in any mailbox.

Appendix B: Advance Notice Letter

"Month" "Day," 2013
Name, Title
Institution Name
Addresss1
Address2
City, State Zip

Dear Pharmacy Director:

A few days from now you will receive in the mail a request to fill out a brief questionnaire for a research project being conducted by Purdue University.

It concerns pharmacist collaborative practice, also called collaborative drug therapy management, and it will be used to assess the current state of collaborative practice in hospitals

I am writing in advance because we have found many people like to know ahead of time that they will be contacted. Your institution was randomly selected as part of a national sample of hospitals. Your responses are needed regardless of whether your institution has pharmacist engaged in such activities. Your responses combined with those of other pharmacy directors will provide a picture of the current state of collaborative practice and likely future trends in this evolving part of pharmacy practice.

Thank you for your time and consideration. It is only with the generous help of people like you that our research can be successful.

Sincerely,

Joseph Thomas III, Ph.D.
Professor

Appendix C: Cover Letter for First Mailing

"Month" "Day," 2013

Name, Title
Institution Name
Addresss1
Address2
City, State Zip

Dear Pharmacy Director:

Pharmacist collaborative practice or collaborative drug therapy management that involves pharmacist initiation and/or modification of drug therapy has received much attention as a means of improving medication use and outcomes. We are working to assess the current state of collaborative practice in hospitals. Please assist us in this effort by taking a few minutes to complete the enclosed survey designed to collect information on whether hospitals have pharmacists involved in such activities, what specific activities pharmacist engage in, in which disease areas such activities take place and the impact of such activities upon the strategic position of pharmacy services in hospitals.

Your institution was randomly selected as part of a national sample of hospitals. Your responses are needed regardless of whether your institution has pharmacist engaged in such activities. Your responses combined with those of other pharmacy directors will provide a picture of the current state of collaborative practice and likely future trends in this evolving part of pharmacy practice. There is a code number on surveys, but it only identifies the hospital so that we may follow-up on responses. Only grouped anonymous data from the surveys will be reported without identification of any individual or institution.

Return postage on the survey is prepaid. After completing the survey, simply refold it with the business reply side out and seal with a small piece of tape before placing it in any mailbox. Thank you.

Sincerely,

Joseph Thomas III, Ph.D.
Professor

Pragya Mishra
Pharmacy Student

Appendix D: Cover Letter for Final Mailing and Reminder Postcard

"Month" "Day," 2013

Name, Title
Institution Name
Addresss1
Address2
City, State Zip

Dear Pharmacy Director:

About twelve weeks ago, you should have received a survey on pharmacist collaborative practice in hospitals. Although you may have received a prior reminder about the survey, we are writing again because your individual response is very important. Regardless of whether your institution has pharmacists engaged in such activities or the extent to which pharmacists are engaged in such activities, your responses are essential to the project findings reflecting the full range of hospitals.

Please assist us in this effort by completing and returning the survey. All information collected will be kept strictly confidential. A code number on each survey, only identifies each hospital so that we may remove hospitals that have responded from follow-up mailings. Only anonymous grouped data will be reported without identification of any individual or institution.

Another copy of the survey is enclosed for your convenience. Return postage is prepaid. Simply refold the completed survey with the business reply side out and seal with a small piece of tape before placing it in any mailbox. Thank you very much for your assistance.

Sincerely,

Joseph Thomas III, Ph.D.
Professor

Pragya Mishra
Graduate Student

Appendix E: Reminder Postcard

Postcard Thank you/Reminder

Last week a questionnaire seeking your opinion on pharmacist collaborative practice in hospitals was sent to you. Your institution was randomly selected as part of a national sample of hospitals

If you have already completed and returned the questionnaire to us, please accept our sincere thanks. If not, please take a few minutes to do so today. Your individual response is very important and essential to project findings reflecting the full range of hospitals, regardless of whether your institution has pharmacists engaged in such activities. All information collected will be kept strictly confidential.

If you did not receive a questionnaire, or if it was misplaced, please call us at------- and we will get another one in the mail to you today.

Joseph Thomas III, Ph.D.
Professor

Pragya Mishra
Pharmacy Student

Appendix F: Sampling Fractions

Table F1. Sampling Fractions, Stratified by State

State	Hospital Count	Number in List	Sampling Fraction	Rounded Off (N=1026)
AK	21	8	3.26	3
AL	129	48	20.07	20
AR	100	37	15.56	16
AZ	101	37	15.71	16
CA	492	182	76.55	77
CO	89	33	13.84	14
CT	50	19	7.78	8
DC	15	6	2.33	2
DE	14	5	2.17	2
FL	306	113	47.61	48
GA	198	73	30.80	31
HI	23	9	3.57	4
IA	126	47	19.60	20
ID	38	14	5.91	6
IL	222	82	34.54	35
IN	174	64	27.07	27
KS	143	53	22.25	22
KY	132	49	20.53	21
LA	173	64	26.91	27
MA	124	46	19.29	19
MD	74	27	11.51	12
ME	45	17	7.00	7
MI	177	65	27.54	28
MN	135	50	21.00	21
MO	154	57	23.96	24
MS	125	46	19.45	19

Table F1. Contd.

State	Hospital Count	Number in List	Sampling Fraction	Rounded Off (N=1026)
MT	51	19	7.93	8
NC	150	56	23.34	23
ND	41	15	6.37	6
NE	77	28	11.98	12
NH	32	12	4.97	5
NJ	113	42	17.58	18
NM	55	20	8.55	9
NV	53	20	8.24	8
NY	263	97	40.92	41
OH	235	87	36.56	37
OK	147	54	22.87	23
OR	63	23	9.80	10
PA	269	100	41.85	42
RI	17	6	2.64	3
SC	104	38	16.18	16
SD	51	19	7.93	8
TN	169	63	26.29	26
TX	606	224	94.29	94
UT	49	18	7.62	8
VA	133	49	20.69	21
VT	15	6	2.33	2
WA	110	41	17.11	17
WI	147	54	22.87	23
WV	66	24	10.26	10
WY	30	11	4.66	5

Appendix G: Distribution of Responses on Opinions about Collaborative Drug Therapy Management

Table G1. Distribution of Responses on Opinions about Collaborative Drug Therapy Management (CDTM)

Response	Number of Respondents choosing each Response				
	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Range and Type Of Activities					
The range of diseases in which collaborative practice involving pharmacist initiation or modification of drug therapy (CP) is applied is too narrow	2	27	85	122	34
Pharmacists who provide CP have access to necessary patient medical records without any difficulty	4	22	29	77	138
Pharmacist should have prescribing authority independent of physician-approved protocols	16	47	87	76	44
The range of decisions that may be made for patients in which CP occurs is too broad	35	132	92	8	1
My hospital's protocols on CP are clear	6	24	75	109	52
My hospital's protocols on CP are too restrictive	20	81	114	38	10

Table G1.Contd.

Response	Percent of Respondents choosing each Response				
	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Support for CP					
Upper hospital administration is supportive of CP	4	15	73	126	51
Physicians in my institution are not supportive of CP	15	42	88	71	48
The pharmacy staff is supportive of CP	2	9	33	149	77
CP enhances the relationship between pharmacists and physicians	3	7	20	130	110
I am supportive of our pharmacists being involved in CP	1	6	14	80	169
CP impairs relationships between pharmacists who provide CP and those who do not	40	87	87	39	16
My management staff is supportive of our pharmacists being involved in CP	3	10	56	96	105
Nurses are supportive of our pharmacists being involved in CP	1	6	54	108	101

Table G1 Contd.

Response	Number of Respondents choosing each Response				
	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Patients appear comfortable with the expanded role of pharmacists in CP	0	0	88	122	45
Effects of CP					
Providing collaborative services enhances upper administration's perceptions of the value of pharmacists	0	1	38	133	91
CP has facilitated implementation of other pharmacy services	2	12	77	121	48
Physicians have asked my staff pharmacists to advanced services because of CP	6	24	76	100	55provide more
Financial					
CP has helped pharmacy maintain resources	10	27	101	79	39
Third party payers provide reimbursement for some CP activities	54	72	92	31	8

Table G1 Contd.

Response	Number of Respondents choosing each Response				
	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
CP has helped pharmacy obtain more funds for staff salaries	37	88	99	24	6
CP has helped pharmacy limit reductions in resources	25	49	103	66	14
CP has helped the pharmacy department obtain more resources	23	71	101	48	15
Regulation affecting CP					
Current state regulations on CP are too restrictive	2	44	110	73	34
Current state regulations on CP encourage CP	12	49	135	60	6
Current state regulations on CP do not need changes	29	93	116	24	1
Current regulations on CP inhibit CP	9	54	143	39	18